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(J. A. BERLY'S).

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UNIVERSITY DEGREES IN ENGINEERING.

UNDER the above title, Prof. J. A. Fleming, D.Sc., F.R.S., contributed to *Engineering* of January 8th a long and weighty article, well worth consideration in its entirety, on account of the ability and educational experience of the author.

It is, no doubt, significant that in two succeeding weeks articles should appear in two engineering papers such as the one which we are considering and the sarcastic article of "Tito" in the following number of the ELECTRICAL REVIEW.

Both deal with the making of engineers. In the one we have a learned engineering professor discussing the qualities necessary to the engineer, and how best to recognise, train and hall-mark as engineers, those possessing these qualities. In the other we have, apparently, a working engineer—duly capable and qualified, let us hope—pointing out that those graduates in engineering, whose fitness for the profession and whose training Prof. Fleming considers—and rightly considers—worthy of the closest attention, are in competition with the self-selected and self-qualified engineers. Dr. Fleming writes of the selection and education of the engineer as a professional man, though evidently he is not ignorant of the existence of the other type of engineer, since he writes of "a youth who aspires to find a place in the ranks of that wide profession or business embraced under the term engineering.

If engineering were a profession—as medicine is a profession—with recognised standards of general and special knowledge, with a governing body to enforce these standards, and with legal prohibition against the practice of the profession by outsiders, it would be possible—as it is certainly desirable—to organise the selection and education of engineers on the following lines, as set out by Dr. Fleming:—

> The object of engineering education must therefore be to sift out from the youthful part of the community those who naturally possess these practical creative mental faculties, or in whom they can be usefully developed. To encourage an indiscriminate entrance into these pursuits under the idea that they offer a pleasant means of livelihood in which no particular personal qualities are required is to foster a delusion. On the top, however, of a natural aptitude, there must come a suitable training, and if university degrees of diplomas in engineering are to have any value at all beyond a meaningless addition of ornamental initials, they must be an evidence of this aptitude and training. Moreover, it is desirable that the particular attainments of which the degree is the hall-mark shall be definite and well understood, and that competition between degree-giving institutions for candidates or students shall not lead to an undue lowering of the standard of attainment.

If all the conditions are reversed—if there are no recognised standards, no governing body to enforce these standards and no monopoly of employment for those qualified—it is hopeless to enforce such an ideal of selection and qualification. Powers in this direction are limited by the very practical consideration that only such standards can be enforced, as the

voluntary students will accept, in sufficient numbers to justify the cost of the teaching. The limitation leads directly to the "undue lowering of the standard of attainment," which the author regards as undesirable, but which is, under the circumstances, inevitable and, it is to be feared, progressive.

To appreciate the situation as it exists in engineering, it is only necessary to consider the probable effect upon medical education, if every druggist were a doctor, and every druggist's assistant a doctor in the making. Does anyone suppose that, under those conditions, it would be possible to impose a four years' course in medicine, that it would be possible to keep the average of medical education at its present level, or that the statements of great physicians and great surgeons as to the qualities necessary for a doctor, and the training to which he should be subjected, would be anything but academical disquisitions?

With this reservation, then—that the ideal cannot be realised in practice, under present conditions—let us see what the ideal is:—

> It is the function therefore of the degree syllabus to save him from premature specialisation in his studies, which would mean subsequent disadvantage. If, then, there is to be systematic educational preparation for the profession of engineering, and appropriate tests of its results by degree examinations, it is clear that these should possess the following characteristics:—
>
> 1. They should afford some means of sifting out the fit from the unfit in respect of mental attainments and qualifications for the profession of engineering, including amongst these the power of strenuous, painstaking work and a practical turn of mind.
>
> 2. They should limit as far as possible premature specialisation in studies and compel a broad education, the ideal to be kept in view being to know a little of everything and everything of something.
>
> 3. They should not be tests chiefly of memory or the reproduction of acquired information, but test to some extent the power of grappling with difficulties of an engineering nature, and also test the candidate's originality.
>
> 4. The degree should not be allowed to become an end in itself as an academic success, but should be a proof of having completed a carefully-selected and not too narrow course of practical training, covering, however, the range of knowledge required in some recognised branch of the engineering profession or business.

This is an excellent four years' course for a young and ambitious man with brains, money, time, "the power of strenuous painstaking work and a practical turn of mind," and with a certain professional opening assured at the end of his training; for a young man, say, who through money or influence can command a start in a big engineering works or with a big consulting engineer; possibly for one content to teach engineering. It is very doubtful whether such a thorough engineering training would—as an investment of time and money—pay a young man bent on engineering, but not in possession of these advantages, so well as apprenticeship, even with the immediate and sometimes very narrow specialisation, and without the selection, the general education, and the general knowledge—that is to say, with all the defects which apprenticeship usually implies, and which Dr. Fleming seeks to guard against. Early specialisation—even the narrowest and crudest—is, unfortunately, a safer policy than the gaining of a wide, general education in a "profession or business" in which the general ranks are open to all and sundry.

If the arguments put forward in this article are sound, then it is safe to conclude that the selection and training of engineers must remain in its present chaotic condition, to the great detriment of the profession, until such time as the governing bodies of the Engineering Associations combine to compel the recognition of their common profession. Then—and not till then—it will be possible to select those suitable and to train them generally for the profession of engineering, leaving them qualified and free to specialise in any direction. The diploma of specialisation may be bestowed by the governing body of the special branch specialised in.

L.B. & S.C.R. Electrification.

On Sunday evening last, towards midnight, we had the pleasure of taking part in a trial run upon the "South London Line" of the London, Brighton and South Coast Railway, between Battersea and East Brixton; the electrical equipment of this portion of the line has been completed, and in a few weeks the section will be in working order as far as Peckham Rye. It is anticipated that by the end of May electric trains will be running over the whole of the line from Victoria to London Bridge, 9 miles in length.

The trial trip was successful in every respect, and justified us in extending our hearty congratulations to the electrical engineer, Mr. Philip Dawson, who is responsible for the whole of the work of electrification; the first part of a special article from his pen on the subject of railway electrification appears elsewhere in this issue.

The electric trains, as we have previously mentioned, differ considerably from any hitherto constructed for London lines, being of the compartment type with side doors, and having a corridor along one side, by means of which passengers may distribute themselves throughout the coach after the train has started. This is an admirable arrangement, calculated to facilitate ingress and egress to the utmost whilst providing for the comfort of passengers. The drawbacks of the type of coach adopted on the other London electric railways have been disagreeably impressed upon the perception of every person who has had occasion to use them, especially at busy times, and we trust that the too hasty imitation of American methods, which has on previous occasions similarly led us astray, has now run its course for good. The design adopted for South London generally resembles a type which has been successfully employed in the North of England for many years. It is interesting to note that no "straps" are provided in the new trains, though racks are fitted for parcels. Very special attention has been devoted to the lighting and ventilation of the coaches, matters which have not always been adequately provided for.

It is hoped that by means of the electric service it will be possible to regain the local traffic which has temporarily been filched from the railway by the tramways and motor-omnibuses. If the experiment results in a commercial success, we shall see a great extension of the system, not only upon the Brighton Company's lines, but also upon the many other London railways which are impatiently awaiting the result of the present electrification.

The Rule of the Road.

The case of Burton *v.* Nicholson, which was recently decided by the Divisional Court, affords a striking example of the ill-success with which old rules of law may be applied. Ought a motor-car to be allowed to pass a tramcar going in the same direction on the near side? Motorists say Yes; the law says No. In the case under notice a motor-car was following a tramcar, the lines being in the centre of the road. The tramcar stopped to take up passengers, and another tramcar, coming in the opposite direction, stopped alongside of it for the same purpose. The motor-car passed on the near side. The driver was summoned and convicted and the conviction was upheld on appeal. This result is due to Art. 4 of the Motor Car (Use and Construction) Order, 1904, which provides that:—

"Every person driving or in charge of a motor-car, when used on any highway, shall comply with the regulations hereinafter set forth—viz.: he shall, when . . . . passing any carriage, horse or cattle proceeding in the same direction, keep the motor-car on the right or off side of the same." . . . "The expression 'carriage' includes a wagon, cart or other vehicle."

It is legitimate to wonder what the Local Government Board had in their minds when this order was drawn. As the Lord Chief Justice, in giving judgment, said: "No doubt it was intended to apply to motor traffic the customary rules of the road, but it has been overlooked that so far as regards ordinary horse traffic, the ordinary rule has been modified by the coming into existence of tram-rails and vehicles on them which cannot move laterally." He proceeded to cite the exceptional case of a tramcar passing along

the Thames Embankment in order to show that, however well intentioned, the order did not meet modern requirements. If the order has been correctly construed, what is the position of the motor-car driver when there is no room to pass on the off side of a tramcar? He must follow the car in front of him, and stop every time it stops to take up a passenger, or else take his chance of getting round safely. That is a risk which the driver of a motor-car will seldom care to run, seeing that his vision is generally obscured by the tramcar immediately in front of him. It may be that the law requires amendment; but as it is absolutely necessary to protect persons getting into or out of a tramcar, there might be some proviso to the effect that a tramcar should not be passed when stationary at a stopping place.

Water Hammer in Steam Pipes.

The Memorandum for 1907 of the Manchester Steam Users' Association has recently been published; its chief interest lies in the prominence given once again to the question of water hammer in pipes. Mr. Stromeyer, the chief engineer to the Association, has for long devoted special attention to this matter, and he now deals with the dynamics of the subject, and shows by figures what velocities may be attained when a plug of water is driven along a pipe towards a vacuous space, and what pressures are thereby set up. Obviously the pressure set up when a plug of water is brought to a stop will be determined by the mass of the plug and its velocity.

The velocity of the plug will be proportional to two factors—the distance travelled by the plug under the impelling action of the steam behind it, and the net effective pressure. The velocity attained may be enormous: 1 lb. of water, measuring about 30 cb. in., and forming a plug 30 in. long, actuated by a pressure difference of 100 lb. will attain a velocity of 3,200 ft. per second in 1 second of time, or 320 ft. per second in one-tenth of a second, during which time it would travel 160 ft. It is fortunate, perhaps, that such long runs are not often found. Water being so nearly incompressible, the stoppage of a moving mass suddenly cause an immense pressure, and burst a pipe. The most serious effects are only obtained where the vacuous pipe is of some length, and the water plug is short, and danger is avoided, no doubt, because steam valves are cautiously opened, and full pressure is not admitted until any water plugs have been pushed comparatively slowly to the extreme ends of their pipes. But it is shown how very easily it may happen that a pressure of as much as 16,000 lb. per sq. in. may be created. This would burst any pipe. The conditions to cause such a pressure may occur when a drain cock is opened, and an accumulation of water in a pipe drains away in a vertical branch on a horizontal pipe. So soon as the water level falls below the top of the horizontal pipe and a long surface of cold water is exposed to steam, the steam rushes into the cold water, condensation being practically instantaneous. Just at the bend the steam will pick up the water and raise a wave that will close the steam way along the crown of the pipe. Beyond the wave there is promptly formed a vacuum, and the wave is shot forward to work its mischief. There is no mystery about it, and the reason there are not more explosions is that attendants probably keep open the drain cocks of pipes not containing steam, and so many pipe joints leak slightly that when steam is shut off and the drain cocks are not left open, air leaks in and prevents or reduces the intensity of the vacuum effects. Then, again, there are *some* steam-tight valves which do not let water form in the pipes; there is also a good deal of mild steel piping in use to-day, and this material appears capable of withstanding very severe stresses.

The report goes on to show that cast-iron is but 7 per cent. better than an imaginary inelastic material which will not stretch before it breaks. Mild steel behaves a little better up to the elastic limit, and beyond that limit has an enormous reserve of strength available; this is shown by calculation. Practice also proves it, for only one steel pipe is reported to have burst, as against hundreds of cast-iron pipes. But it is not recommended to make low-pressure pipes of steel. Cast-iron should serve well enough if care be taken to prevent water lodgments and to drain effectively and constantly.

Apropos of the enormous rapidity with which steam rushes into a vacuum, the question may be regarded from the point of view of the kinetic theory of gases. Steam molecules have a translatory velocity at 0° C of nearly 1,806 ft. per second, and this velocity increases in direct proportion to the absolute temperature. Steam velocities of over 2,000 ft. per second may, therefore, obtain when a cold water surface is exposed to high steam pressure, and the steam will rush into that cold surface at that velocity. Every engineer knows that on an ordinary condenser exposed to intermittent steam admission from an engine, the vacuum gauge will remain almost at rest. This merely proves how very rapid is the flow of steam into the cold surfaces of the condenser, and incidentally also it offers a sufficiently satisfactory explanation of the phenomenon of cylinder condensation of steam. The upholders of the leakage theory by which some have tried to refute the accepted views of cylinder surface effects, appear entirely to ignore the kinetic theory of steam. But that theory does, at least, account for much, if not all, of the mystery that is invoked to explain certain steam effects.

If not instantaneous, the destruction of steam, which is not more than 3 ft. distant from a cold surface, may occur in little more than the thousandth part of a second. And it is to rapidity of condensation that hammer blow in steam pipes is entirely due. It may be added that the velocity of 3,200 ft. above named is practically impossible, for no plug of water can travel faster than the molecular velocity of steam. But anything below 2,000 ft. may at any time be attained.

Electrification of the Railway Terminals in Chicago.

The *Electric Railway Journal* a few months ago reported a highly interesting state of affairs in Chicago, the shareholders of the Illinois Central Railway having resolved that it was the sense of their annual meeting that the directors should proceed to electrify the service within the city of Chicago. To this the directors replied with the following somewhat ambiguous resolution: "That the demand of the citizens of Chicago that the railroads entering the city should take such steps as will reduce to the lowest possible limit the annoyance caused by noise and smoke is a reasonable demand, and this company should and will give immediate attention to the attainment of that end."

Not long ago the chairman thought electrification impossible under present circumstances, but it is to be hoped that he has been brought to a different frame of mind by the report of the Commission which was appointed early last year by the mayor, and that the Board mean rather more than they say in the resolution just cited.

The Commission does not appeal to an Englishman as being very strong, composed as it was of—

The Commissioner of Health.
The Chairman of the Local Transportation Committee of the City Council.
A Consulting Mechanical Engineer.
The Chief Inspector of the City Smoke Department, and his assistant.

The Commission was appointed in the first place to find some remedy for the locomotive smoke nuisance, and it could only find that electrical working would cure the evil; the Commission proceeded thereupon to collate information from all sources to prove that the conversion to electricity would prove successful commercially. The Commission worked upon a concrete case during the whole of its investigation, taking for this purpose the Illinois Central terminal, as this is situated in one of the best parts of the city; and it firmly believes that the operation of the entire terminal electrically is quite feasible, because the requisite capital is available, and the change will save the company enough in working costs to pay the fixed charges on the added capital, besides providing for depreciation.

The Commission estimates the cost of electrification without a power station at less than £900,000, and shows a net annual saving of £53,000, apart from any increase of revenue.

We hope that before long Chicago will be free from locomotive smoke, and that the optimistic views of the Commission will be realised.

RAILWAY ELECTRIFICATION.

By PHILIP DAWSON.

The only arguments which can be reasonably raised in favour either of the electrification of existing lines, or of new ones, are of a financial nature.

Electricity must reduce working expenses or increase gross receipts, or alternately decrease the capital expenditure required in the construction of a given line; or enable a larger number of trains to be operated over existing systems than would be possible with steam, thus saving the additional capital expenditure which would be required for increasing the number of tracks and station platforms which would otherwise be involved by an increase in the train service if steam were retained as the motive power. In any case where it is impossible to definitely prove that some such financial advantages exist, as have been referred to above, there can be no question of considering the introduction of electric traction.

The principal advantages from this point of view in connection with long-distance electric traction, arise in the case of new lines from the cheaper construction possible, owing to the admissibility of more severe gradients with electric, than with steam traction. In the case of existing steam-operated lines advantages arise in consequence of the saving in operating costs which can be obtained where coal is expensive and water-power is abundant, and the further benefit of rendering a country self-supporting and not dependent on export coal from other countries. Incidentally, the installation of electric traction under these conditions offers the additional advantage of rendering electric power available for manufacturing and other purposes along a railway system, which might otherwise never have been developed.

Having thus briefly considered a few of the advantages presented by electric traction in the case of long-distance lines, we will consider in a similar way the advantages which will accrue to British railways by the electrification of their suburban lines, and what are the reasons which should weigh most in the minds of the railway authorities in favour of such a change.

In this connection, it should be clearly understood that the only lines on which electric traction should be considered, at least as far as this country is concerned, are the suburban lines, on which the distances between stations are comparatively restricted (under one mile) and over which a very frequent service of trains has to be operated. Thus, as far as London is concerned, one may roughly call the suburban system of a railway anything which is within 20 or 30 miles, say, of Charing Cross. The principal advantages of electric traction in this case are due to the property possessed by electric motors which will enable them to produce what is called rapid acceleration; or, in other words, to obtain the maximum travelling speed in a very much shorter time than is possible with steam. Thus, taking the extremes, whilst the maximum which has been practically possible with steam is a speed of something like 27 miles an hour in 50 seconds, experiments at the General Electric Co.'s works in America have shown that it is quite possible, electrically, to obtain 40 miles an hour in 30 seconds. This latter acceleration is, of course, much too high from the point of view of comfort to the travelling public, and with electric traction on suburban systems, it is more usual to obtain anything from 25 to 32 miles an hour in 30 seconds.

This property of the electric motor enables the average speed of the trains to be very considerably increased, and according to circumstances, anything from 25 per cent. to 50 per cent. to be deducted from the time required for travelling between any two stations on a suburban line. Thus, in the case of the Brighton Railway (for the electrification of which the writer is responsible) on the South London line from London Bridge to Victoria and *vice versa*, there will be a saving of 11 minutes, for whilst with steam it takes at the present moment 36 minutes to do the same distance with electricity, this journey will be easily performed in 25 minutes. There are very many other advantages of equal importance which must be taken into consideration when investigating the question of the electrification of suburban systems.

Thus the increase in the speed of travelling possible with electricity will be useless unless a much more frequent service is at the same time installed; again in this instance electricity comes to the aid of the railway manager.

Steam locomotives may be considered very economical and efficient when they run long distances and haul heavy trains for such distances with few or no stops; or, in other words, when they are exerting tractive effort during the whole time they are running. Under these conditions they use something in the neighbourhood of 4 lb. of coal per H.P.-hour, or, according to the weights of the train, anything from 35 to 60 lb. of coal per train-mile.

The moment the locomotive is utilised for suburban work, this sort of thing disappears; experience shows that the amount of fuel burnt during the time a suburban locomotive is in actual service is very little less than that which would be burnt by such a locomotive if it were running and exerting tractive effort during the whole time it was in service. In other words, the amount of fuel consumed per train-mile or per ton-mile is very much greater in the case of locomotives doing suburban work, than of a main line locomotive as referred to above. It clearly follows that with steam it must, therefore, be more economical to have as few and as large suburban trains as possible rather than a large number of smaller trains, for the cost in the case of a steam locomotive is nearly proportional to the train-mileage, and practically independent of the ton-miles hauled. In the case of electric traction it is quite different, for here the amount of energy consumed is proportional to the ton-mileage, and under these circumstances there is very little difference in the operating expenses caused by running a large number of small trains, rather than a small number of large trains. It will therefore be seen that electricity again enables the general manager of a railway not only to increase the average speed of travelling, but also the frequency of the trains, which, as I have shown, is absolutely essential if the full benefits of increased speed are to be fully realised.

Up to the present, in discussing electric traction, we have only compared electric and steam locomotives, but it must also be pointed out that electricity enables the use of what is known as multiple-unit control, that is to say, the equipment of a given number of carriages with motors, each motor-car hauling, or being capable of hauling, a given number of trailers, and a unit train being made up of one or more motor-coaches and trailer coaches as may be considered best.

The multiple-unit system of control thus enables any number of these unit trains to be coupled up and driven by one man just as if they constituted but one train. Such multiple-unit trains can be made up of any number of coaches as desired, and owing to the comparatively reduced maximum speed at which trains of this description have to travel, it is admissible for a motor-coach to push a trailer coach and thus to form a unit where found advisable, consisting of one motor-coach, and one or more trailer coaches equipped with controlling apparatus, so that the train can be driven by a motor-man from either end. The use of multiple-unit trains, and their great advantages, are at once appreciable when the question of termini have to be considered, as is practically always the case when railway electrification is under discussion. At the present moment, taking a terminus like Victoria Station, it takes six minutes after the arrival of a train alongside a platform before the same platform can be available for another train. This is due to the fact that after a train has arrived, the lines have to be cleared in order to enable the engine to be backed on to the train, in readiness to take the same out again, and that as soon as this has been done the line has to be kept clear for the engine which has brought the train in, to be run out again to the particular siding on which it has to wait, until another train is brought in for it to haul out.

With the multiple-unit system of electric traction, this loss of time entirely disappears, as all that is required is the time that it takes the motorman to take off his switch handles, and walk from one end of the train to the other. This time is probably less than would be required to empty

and fill a train, but provided properly designed carriages are used, with side doors, and not with the American form of end doors, from one to two minutes is the maximum time required for any train to occupy a platform. The enormous benefits conferred by this saving of time will be appreciated from the fact that, notwithstanding the very large expenditure which has been made in connection with the reconstruction and enlargement of Victoria Station by the L.B. & S.C. Railway Co., at the crowded hours of the day, with steam traction, it is practically impossible to add a single train to its existing services, a very severe handicap, considering the constant demand of the travelling public for increased train facilities, particularly during the rush hours of the day.

In other words, the introduction of electric traction will enable us (taking into consideration the fact of the small proportion that long-distance trains bear to suburban trains) to more than double the number of trains on a given system, without either increasing the number of tracks or the station accommodation. The cost of operating and maintaining electric trains is certainly smaller than that involved with steam-operated trains, but the advantages I have shown, which are possessed by electric traction, are so great as to make it unnecessary, at the present moment, to discuss economies which undoubtedly will result in consequence of railway electrification, once this system is generally adopted; for, as already mentioned, in order to make electric traction successful financially, the number of trains must be considerably increased, and under these circumstances, it can be safely stated that, although smaller trains will be operated, the total train service can be doubled by means of electric traction without involving any considerable increase in the working expenditure, or any capital expenditure besides that required for the electrical equipment of the system, which figure is a very small one when compared to the expenditure which would be necessary if increased services were attempted whilst maintaining steam haulage.

The introduction of electric traction on a suburban system of one of our great railways, as, for instance, the L.B. and S.C. Railway, would bring many other advantages in its train, some of which are of the utmost importance. Supposing, for example, the whole of the suburban lines between Victoria and London Bridge, and Sutton and Croydon, are equipped for electric traction, and that all the local trains running to Sutton or Croydon are operated electrically, the question will have to be considered as to what shall be done with the main-line trains after they reach either Sutton or Croydon. At the present time most of the trains divide at these two stations, one portion running to the City, and the other to the West-End terminus; such a division involves time, a time which would be no greater if, from this point, electric locomotives were adopted instead of steam, for hauling trains to Victoria and London Bridge respectively. The cost involved by such a change would be very slight, as the electrically-equipped overhead system, feeders, switch cabins, &c., would already be available, and would not have to be increased in order to handle the main-line traffic. The advantages of such a step would be very great, because all the immensely valuable space now occupied by locomotive sheds, locomotive repair shop, coal sidings, turntables, ash pits, water towers and such like, would be rendered available for other purposes, and furthermore, considerable time would be saved at the termini, owing to the electric locomotive being double-ended and requiring no turntables. An electric locomotive when standing does not require to use current, and if switched off could be left by itself, and yet be ready for instant use, whereas this is not the case with steam locomotives. There is, however, another great advantage which could be reaped by such a change, and which is not fully appreciated by many engineers, namely, the great saving of maintenance in steel work which would be effected in consequence of the absence of the corrosive gases emitted by steam locomotives. What this corrosion means may be seen by the fact that some bridges have had to be renewed within ten years where they are subjected to the hot gases and sulphurous vapours emanating from the steam locomotives. As long as steam is employed it is practically impossible to repaint steel structures with any reasonable chance of success where they are within a few feet of steam locomotives, whereas, if electricity were adopted, they could always be properly painted and kept in working order, and the length of their life enormously increased.

In considering the advantages of electric traction it must not be forgotten that an electric locomotive is not only more efficient than a steam locomotive, but that it costs less to maintain, that the hours of service which can be got out of an electric locomotive per annum are much greater than those which can be obtained from any steam-driven locomotive.

Thus experience has shown that in the case of steam locomotives operating on suburban lines, out of the total life of a locomotive, which may be taken at about 25 years, only about 28 per cent. is utilised in actually hauling trains; it is consuming fuel and wearing itself out during approximately 76 per cent. of its life, the remaining 24 per cent. being spent by it in repair sheds and in being generally overhauled and maintained. In Germany it is found that the average working hours per locomotive, work out at about 12·8 hours per day, but that out of this time two hours per diem. are necessary for preparing the engine and for getting it under steam, and for raking fires and cleaning smoke tubes at the end of a day's work; a further hour is every day required to take any additional fuel and water; and when the fire is out an additional hour for washing out the boiler; so that out of the 12·8 hours in which it is actually supposed to be engaged in doing work, it is only effectively in use for 8·8 hours.

Figures show, as regards the Prussian Government Railways, that out of a total number of steam locomotives owned, only 54 per cent. are actually in service. The repairs of steam locomotives as a rule are most important in connection with its boiler, which puts the whole locomotive out of service; with electric locomotives, the repairs are of such a nature as not to put a locomotive out of service for any considerable time, as most defects or worn-out parts can quickly be replaced whilst in service.

The calculations which have been made by the Prussian Government have led them to conclude that assuming equal work and allowing an equal amount for reserves, 36 per cent. less electric locomotives are required than would be necessary when steam locomotives are employed.

In considering the problem of railway electrification, it is necessary to point out that there would appear to be only two rational courses which can be pursued by a railway in order to meet tramway competition. The one would involve the entire shutting down of the whole suburban system, no trains stopping within, say, 15 miles of the terminus, this would mean that a very large number of lines, sidings and stations, which can only be used for suburban traffic, would have to be shut down, and their capital value, representing a very large figure, written off, as well as the decrease of gross receipts (a very large item) which would result from the entire abandonment of local traffic.

What tramway and motor-omnibus competition means can be gathered from the statement that five railway companies: the Great Northern, the London and South-Western, the London, Brighton and South Coast, the Great Eastern, and the South-Eastern and Chatham, carried between them nearly 35,000,000 passengers less in 1907 than they did in 1903, and this loss of passengers accounted for the loss of money of over £177,000, and it should be noted that this loss is constantly increasing, owing to the extension of tramway systems; the reduction of local train services will further greatly increase the loss of revenue whilst but very slightly decreasing the working expenses of the system, and it would therefore appear that, even if the Board of Trade and the Government could allow railways to entirely abandon the whole of their suburban traffic, the losses resulting from such a step would be such as to make such a solution a most unpractical one.

The only method of dealing with this difficulty is by increasing the average speed and frequency of the trains, which, as has been shown, can only be done by electrification. Experience has shown that in Great Britain, at least, the average speed of tramways cannot exceed about 10 miles per hour, and that under favourable conditions of railway traffic, the limit of tramway travel is about five miles, and everything beyond five miles will come back to the railway, provided electrical service is introduced. Facilities for travelling always increase the travelling habits of the people; experience in this country amply confirms that of other

countries, and conditions are such that if all that can be secured by the railway companies in consequence of electrification is simply to recuperate their lost ground, such a step will be amply justified. Probably the greatest electrification of a railway which has ever been carried out has taken place in New York City, where for about 30 miles outside New York, both the New York Central and the New York, Newhaven and Hartford are running electrically; the local trains are operated on the multiple-unit system, whereas trains going long distances are hauled by steam until the electric zone is reached, when electric locomotives take the place of steam. The primary cause of this change was the danger caused by the long tunnel through which both railways have to pass on their entry into New York, and the necessity of entirely doing away with steam if these dangers were to be avoided. The results obtained by this conversion have been entirely satisfactory to the railway companies, and indeed, Mr. Smith, the third vice-President and general manager of the railway, informed the writer last summer that electrification had been the salvation of his railway. The railways already opened have given such satisfactory results, that the Illinois Central Railway, which has an enormous passenger traffic in Chicago, has decided to operate the whole of its suburban system by electric traction, a step the importance of which can scarcely be appreciated at its proper value. But it is not only in America that large things are being considered, for Germany, with its very excellent State-owned railway system, has been carefully watching events, with the result that, after most thorough investigation of everything that has heretofore been done, the Prussian Government has definitely decided to convert the whole of the Berlin Urban and Suburban Railway system to electric traction, at an expenditure of 10,000,000 sterling.

(*To be continued.*)

PRACTICAL NOTES ON TRANSMISSION LINES.

[CONTRIBUTED.]

In planning an overhead transmission line, aluminium should be taken into consideration. With a commercial purity of about 99·6 per cent., it commends itself for its cheapness and light weight. The latter was forcibly brought home to the writer by seeing two labourers carrying between them a partly emptied drum of aluminium line wire on a piece of pipe, while the lineman was turning the drum and so paying off the wire. This lightness enables the poles to be spaced further apart, thereby reducing their number. Even at the present low price of copper a substantial saving can be made by substituting aluminium, in wire alone, notwithstanding the increased section (1·63) which aluminium must have for equal conductance to that of copper. It is claimed to be less affected by changes in the weather than any ordinary metal, but after it had been in use about a month the writer noticed a decided softening in the nature of the wire. His company have seven miles of E.H.T. aluminium line run in exposed districts, and it is giving satisfaction. Aluminium binding wire only should be used for binding to the insulators, as copper, brass, or iron has a very injurious effect on the line wire.

The softening above mentioned seems to confirm a statement to the effect that it would elongate considerably before fracturing. Jointing is very easy; where the two wires butt each other, heat on each side with a blow lamp, and when softened push the two ends together so that the clean metal in each comes into contact.

With an increased section, aluminium has to stand greater stress in a wind or snowstorm, with a tensile strength only ·75 that of copper for equal conductance. This demands a greater sag.

Its temperature cofficient is 34 per cent. higher than that of copper.

It is advisable not to use a smaller gauge than a No. 8 S.W.G. hard-drawn copper wire, or other metal of equal conductance, for a transmission line.

When shackling off at the terminus of an overhead line, instead of fixing the ironwork on the outside of the building, with a shed to shield the shackle insulators from the rain, etc., it makes a good and satisfactory job to fix a channel-iron about 2 ft. inside the building and glaze the openings where the wires enter, so as to keep out the wet. This keeps the insulators dry and clean, and also protects any necessary joints. The hole through the glass may be 3 in. in diameter, but this does not prevent small birds from entering and becoming a nuisance, and a small wire guard has to be fixed. If the line dips into the station, a small ring, either of tape or other substance, on the wire just outside the building prevents any water from running down into the station.

Where a main line is feeding a branch sub-station, if this can be built in a direct line with the poles, so that the wires pass through a corner or the middle of the station tower, then the glazing mentioned above again comes into use and no shackling off is necessary.

Wooden poles should be of red fir in good condition, free from large knots, and creosoted 10 lb. per cubic foot. The depth in the ground and the filling-in vary according to circumstances. The nature of the ground, or the stress which the poles have to withstand, such as an angle strain, may call for filling in with concrete. Usually, clay, well pounded around the pole, is sufficient. The depth is according to length:—

A 30-ft. pole	should be	5	ft.	in the	ground.		
„ 40	„	„	„	6	„	„	„
„ 50	„	„	„	7	„	„	„
„ 60	„	„	„	8	„	„	„

Poles may be set 40 to 50 yd. apart. Wooden arms should be of sound oak; otherwise, channel or angle iron could be used.

A satisfactory job is made by using galvanised wrought-iron brackets with an earth wire of galvanised iron running throughout and connected to all brackets, so that by the failure of an insulator, there is little risk of the pole being fired. In colliery districts, owing to the danger of ground subsidence, overhead lines are better within certain limits as regards section of wire than underground cables, and if a single spare wire is run to provide against a breakdown, it is all that is necessary, as it is hardly likely that all the wires composing the feeder will fail at the same time. If a duplicate feeder is desired, it is better to make it a separate line, so that alterations or repairs can be effected on either feeder without stopping the supply.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Tired Arc Lamps.

I think the trouble which your correspondent mentions is often caused by moisture and dirt getting into the mechanism of the lamp, together with careless trimming.

If the globes have not become coated by deposit from the fumes, the cause must lie in the internal parts of the lamp.

Dash-pots and plungers, for instance, have been known to get so stiff, after the lamps have run in a damp atmosphere for several months, as to prevent anything like a full length of arc being struck. For the same reason rocking levers and other movable parts can all be similarly affected, tending to cause the above result.

In conclusion, I might say that when one's eyes get accustomed to a light it always appears to be about 50 per cent. less than when originally seen, and it would not be surprising to find that these "tired" lamps are giving the same candle power as when first installed.

L. J. Jenkins.

My thanks are due to Mr. F. J. Green for his letter in reply to mine on the above subject. I would, however, point out to him that his suggestion is more "commercial"

than expert. I distinctly mentioned that the effect was noticeable even after the changing of the globes for new ones, and, in an earnest desire to get to the bottom of the matter, it is not likely that the quality of the carbons used would be overlooked. An installation of over 200 enclosed lamps of well-known make, for which all qualities of carbons including the best procurable have been tried, brought my observations up to the point when I thought I might appeal to any arc lamp expert, who might be interested in the matter, through your columns. Everything reasonable has been tried, so that I am convinced that there is something deeper down in the subject that will account for the "tired" effects I mention.

E. W. B.

Electrical Fatalities in Collieries.

I was very much interested in the letter under the above heading in the Electrical Review, January 29th, 1909. I am at variance with the writer on one point, however, and this is when he advocates the elementary electrical training of the collier. Surely he remembers writing in his copy-book: "A little knowledge is dangerous."

While the "common man" underground shows the great respect for anything electrical that, I find, he does in the present day—I say, let well alone. When a man is frightened of anything, he will have as little to do with it as possible, and while you still continue to keep him frightened, your object is attained. I am in favour, however, of information being spread broadcast as to the method of dealing with persons suffering from electric shock.

Another point mentioned is that of adequate inspection. Your correspondent enlarges on the difficulties of travelling underground. He has overlooked the fact that the B. of T. require the inspection to have been completed by the time the men descend. So, you see, the inspection takes place with the roads all free and the mine quiet. The point demanding perpetual inspection is the earth connection. If the inspector makes this his first consideration on arrival at every station, he will—really practically speaking—have finished his inspection. If the earth is all right, it is not likely that death will follow any accident, except by direct short-circuit.

Just one other suggestion, and I have done. If the inspector will look up the daily record of falls, accidents, &c., it will be of great use to him. Let him also examine the shotman's report and see if any shots have been fired in close proximity to his cables. If he then examines all these particular spots daily, and the whole of the cables periodically—say, once a week—his work should prove to be thoroughly efficient.

Cymro.

Featherstone Colliery Explosion.

Mr. Pickering, Chief Inspector of Mines for the Yorkshire district, expressed the opinion that the explosion originated in the switch-box owing to there being an aperture between the lid and the edge of the box. The box was of very unsuitable design, and calculated to prove unsafe in practical work. If colliery owners and managers took the grave responsibility of installing electricity in the workings of fiery mines, they should not altogether rely upon the opinions of electrical experts, who might have very sketchy ideas concerning mining dangers. It was comparatively useless to provide safety lamps and prohibit and restrict shot-firing if electrical appliances which might fire gas were introduced.

The foregoing remarks of Mr. Pickering (Chief Inspector of Mines) at the recent inquest are calculated to seriously affect the electrical trade, and should not be allowed to pass unchallenged by the electrical profession.

The switch-box "was of very unsuitable design and calculated to prove unsafe in practical work"; this being so, who was responsible for its installation?

Again, at the inquest it was proved that the box was defective, "there being an aperture between the lid and the edge of the box." Surely someone was sadly to blame for not inspecting and condemning such a perfect death-trap!

Instead of this the Inspector goes out of his way to discourage the use of electricity in mines; no one is brought to book for the faulty state of the switchgear, but the use of electricity is unjustly condemned.

As already pointed out in the Electrical Review of September 20th, 1907, all mining switchgear should be oil-immersed, and it is a pity that cheapness, the bugbear of electrical mining plant, should permit the use of air-break switchgear at all.

The various German firms have always advised the use of oil switchgear, and are now pointing to the above explosion as one which "would not be possible with our type of switchgear."

As more than one compressed-air receiver has exploded with fatal results, I presume that Mr. Pickering regards the use of compressed air also as very risky.

A central station engineer may possibly not be well versed in the electrical requirements of mining work, but there are plenty of practical electrical mining engineers who thoroughly understand the requirements and the danger of *unsuitable* gear and whose ideas are certainly not sketchy.

R.F.H.

London County Council Turbines.

I personally have had 10 years' experience as inspecting electrical engineer, and can in all truth say that I have, particularly with regard to polyphase work, become accustomed to looking for something quite superior to anything outstanding in the British-made article. The reliability, economy, efficiency, and, lastly, price of the German-made article cannot be gainsaid.

In one specific instance only do I think we score, and that is, that we appreciate the necessity of a higher marginal safety factor in the breaking stresses of shafts, particularly in small units. I have from time to time kept a log of the comparative number of breakdowns arising from faulty workmanship or bad design, and I can say that the home-made article is not all that could be desired. As a matter of fact, compared with German machines the difference is most marked, and is equal to almost three to one.

J. G.

Metallic-Filament Lamps.

I have read with interest the article by Mr. W. H. F. Murdoch, and should like to know more about the subject. Has it been proved that the filament is actually hotter than its normal running temperature? If so, either there is a second increase of current due to the lowering of the resistance as the filament cools a little, or there is some evidence for the resistance-temperature "hysteresis" idea mooted some time ago.

Further, is the luminosity really higher at first, or is the phenomenon apparent only, and due to the contraction of the eye-pupil? The same effect is observed when a carbon lamp is switched on.

Has the effect of a small choking coil been tried for reducing the rush of current on D.C. work?

It would appear also that the time taken for the metal (especially tantalum) filament to cool is due to the smaller radiation of the metallic surface compared with the carbon. I append a few figures for a 4-volt Osram lamp:—

Amperes.	Watts.	Ohms.
·1	·005	·5
·25	·055	·88
·3	·135	1·5 (cherry red.)
·4	·34	2·1
·6	1·08	3
·76	2·3	3·9
·9	3·7	4·55

Enquirer.

[For every temperature of the filament there is a corresponding resistance and current, at constant voltage. The momentary rush of current at switching-on could not possibly heat the filament beyond its normal temperature if the circuit were absolutely non-inductive, unless the resistance lagged behind the temperature, which is not probable. But no circuit is perfectly non-inductive, and hence the excess current which passes while the filament is below its normal temperature does not die away by the time the normal temperature is attained, and thus the temperature is carried beyond the normal for an instant.—Eds. E.R.]

Cheap Wiring.

I have seen a considerable amount of correspondence recently about flexible wiring, as if its use in the upper parts of rooms had some elements of novelty in it.

I have used it for very many years, for example, in the Natural History Museum in Dublin, simply on the ground of appearance, being disgusted at the current barbarities of exposed wiring. I had in this case to avoid some moulded cornices and beams, and used festoons of flexibles between ceiling roses with very good effect.

In recently wiring the 18th century Royal Irish Academy House I was obliged, to avoid unsightliness, to distribute in the wooden floors, bringing up the electrically-connected and earthed steel conduits, exposed, in the back staircase, which extended from the basement to the attic. I used pendants of the simplest possible kind, attempting no effect except what could be obtained by well-designed glass shades and brass ceiling roses and switches. I brought the wires from the switch outlets of the ceiling roses in the floor space to similar roses near the cornices. Loose flexibles in curves roughly approximating to quadrants connected then to similar "ceiling" roses on the walls under the cornices or entablatures, whence they reached the usual wall switches in polished brass tubes. These tubes were symmetrically disposed very much like the old bell pulls.

I may mention, that with few exceptions, I adopt ceiling rose adapters, despite the extra joints involved, in order that if any pendant require attention it can be taken away by a servant with a light step-ladder, put right, and replaced, without unduly disturbing the occupants.

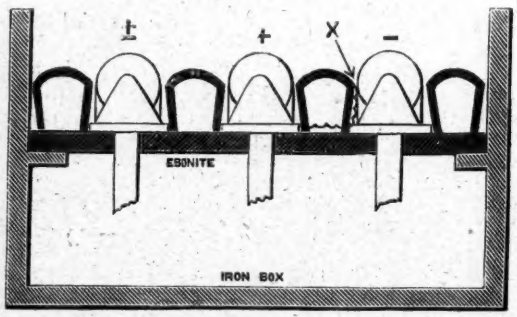
Historic houses and others not designed for the most perfect and sightly methods of wiring, can be treated simply and effectively in the way I describe. Economy may have resulted, but it was not specially sought.

Howard Pentland,
B.A., Art.Inq.Bac., F.R.I.B.A., R.H.A.

Dublin, *January 20th*, 1909.

Fibre as an Insulator.

After fitting up some fuse-boxes on a triple-concentric main, I found it was rather dangerous replacing the fuses, as the space between the poles was about the same as the fuse clips, so for safety's sake I made some bridges out of $\frac{1}{8}$-in. vulcanised fibre, as shown in sketch, and put them between the fuse clips, with an unexpected result. The fibre burnt, and caused the metal to fuse, starting at the point X; the metal ran down and shorted between the 400 volts. I may



+ to −, 400 volts; + to ±, 200 volts.

say that the fibre was damp and flexible when the bridges were made, so I dried them on a hot plate for 36 hours before putting them in the boxes, and they were in about 50 hours, when the fusing took place. I have had about 20 years' experience in electrical work, and have been a reader of the ELECTRICAL REVIEW for the last 10 years, but this is the first experience of the kind I have ever had or heard of, and I should like to hear some other readers' views as to the cause of the trouble.

Puzzled.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"E. H. H." writes:—"Will your legal contributor oblige me with his view of the following? The case does not appear to me to be provided for by any of our special Acts, and I have plenty to do without general legal research. The point should, I think, be of interest all round.

"A shopkeeper, who is a tenant, applies for a supply of electricity, signing the usual agreement. He takes a supply, but in a year or two leaves the premises. The fuses are removed, but the cut-out and cable, the latter being, of course, alive, are left. The premises remain empty a long time; then the landlord alters them, and in doing so disturbs and damages the cut-out and cable. He is billed for the damage, but refuses to pay. The common law says possibly that the cable on private property is the property of the owner of such property, but how about the charged condition of it, and what should be the procedure? To be compelled to remove a cable once put in is a decided hardship on the 'supply' people."

*** The query propounded raises an interesting question which has not hitherto been discussed in this column. Sec. 20 of the Gasworks Clauses Act, 1847, provides that "every person who shall carelessly or accidentally break, throw down, or damage any pipe, pillar, or lamp belonging to the undertakers, or under their control, shall pay such sum of money by way of satisfaction to the undertakers for the damage done, not exceeding five pounds, as any two justices or the sheriff shall think reasonable." This section is incorporated with the Electric Lighting (Clauses) Act, 1899, by Sec. 11 of that Act. Assuming that the undertaking to which "E. H. H." refers is carried on under the Clauses Act, it seems that this provision of the Gasworks Clauses Act (subject to certain conditions) provides an answer to the query. But even if the borough provisional order is not framed on the Electric Lighting (Clauses) Act, 1899, it will probably be found that the order in actual use contains a similar incorporating clause. It remains to consider whether the clause applies. It is to be construed as if "pipe" meant "electric line" (see Electric Lighting Act, 1882, Sec. 12). Did the electric lines which were accidentally injured in the tenant's house belong to the undertakers? It seems to be clear that they did. They were mains, not fittings. In these circumstances they were the property of the supply company. It is not stated, however, whether the result of the landlord's interference was to cause a short circuit. If this was the case, and the damage arose from this cause, the justices might not consider any damages to be reasonable.

Telegraphing over Power Lines.—In *L'Industrie Electrique* M. L. Neu recently described a method of communication over high-pressure power lines by means of high-frequency currents, thus saving the expense of a separate telephone line. The principle is that of superposing a current of very high frequency upon the power currents, by means of the arrangement shown in fig. 1, which consists of a condenser I, an inductance coil S, and a spark-gap A. The line presssure may be used to produce the sparks, or a small transformer, or a spark coil fed from a separate source. At the

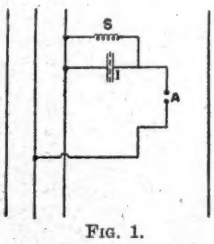


FIG. 1.

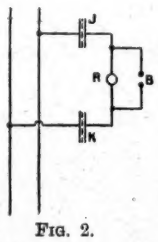


FIG. 2.

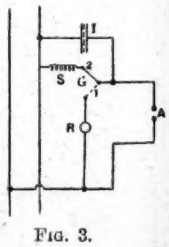


FIG. 3.

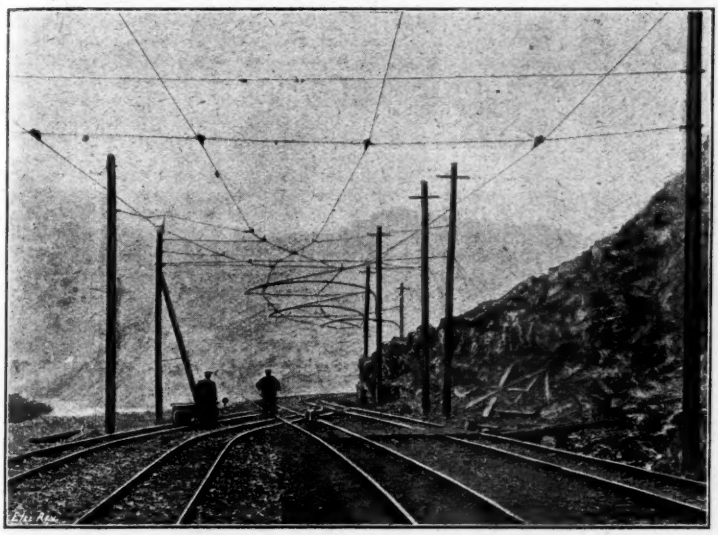
receiving end there is a spark-gap B, fig. 2, in series with condensers J K, and shunted by a relay R, which may be used to close the circuit of a call bell. Fig. 3 represents a combined transmitter and receiver with a throw-over switch G to change from transmitting to receiving. Communication is effected by Morse signals. Instead of using two line wires, one of them may be employed with earth return. The author gives further details showing how the system is carried out in practice.

Society of Engineers.—At the meeting on Monday last, after the presentation of premiums for papers read during the past year (including the President's gold medal to Prof. R. H. Smith for his paper on "Wheel Teeth") the new President, Mr. E. J. Silcock, delivered his inaugural address, which dealt with various aspects of municipal engineering. Mr. Silcock took occasion to draw attention to the general movement towards the registration of engineers and their protection from the competition of unqualified persons, which he cordially endorsed.

SOME ELECTRICAL INSTALLATIONS OF 1908.

The Work of Messrs. Johnson & Phillips, Ltd.

Below we are enabled to give some particulars, together with photographic views, of some interesting work that was carried out by the Contract Department of Messrs. Johnson & Phillips, Ltd., of Charlton, during the year 1908. We are pleased to learn that the year was a particularly busy one for this department, many large electrical installations having been carried out.



Kinlochleven.—Junction on Railway at Wharf.

Loch Leven Power Scheme.

One of the most important electrical works undertaken in the United Kingdom for several years past has been the large operations that have been in progress on behalf of the British Aluminium Co., Ltd., at Kinlochleven, Argyllshire, N.B., where the Loch Leven Water and Electric Power Co. have been erecting a large power station for the purpose of supplying electric power to the new aluminium factory of the company named above. A large dam has been constructed in the hills and the water is transmitted through a 5-mile conduit and pipe line to the power house, situated about ¾ mile from the head of Loch Leven.

To Messrs. Johnson & Phillips was given the contract for the overhead railway equipment for the railway line connecting the wharves with the various factories and the power house, and for the whole of the overhead feeders and distributors for lighting and power throughout the village of Kinlochleven.

The railway consists of about 3 miles of single track, and its equipment is of the overhead type with trolley wire of 1/0 gauge copper supplying power to the locomotives at 500 volts.

The overhead gear having been designed for use with a bow collector it is therefore of a special type.

Creosoted wooden poles, 32 ft. long and 10¾ in., diam. 5 ft. from the butt, were used throughout for supporting the outside brackets or span wires carrying the overhead wires. Along the greater part of the route the wires are supported from bow strings carried by overhanging brackets. These brackets are constructed of T iron, 3 in. × 2½ in. × ⅜ in. section, bent to a suitable shape, 9 ft. 9 in. long for single track, 17 ft. 9 in. long for double track, and 21 ft. 9 in. long for three tracks. The span and bow-string wires are carried on specially designed porcelain reel insulators, so that double insulation is provided throughout.

The lighting and power feeders consist of 37/·085 and 169/·085 bare aluminium cables supported on double shed porcelain insulators carried on angle iron arms bolted to creosoted wooden poles. The house lighting distributors which supply current at 250 volts are 19/·085 bare aluminium cables, and the street lighting distributors are 7/·085 bare aluminium cables, all carried in the same way as the feeders. As few joints as possible were made in the straight run of the feeders and distributors, but where these were necessary they were made by welding the two ends to be joined together.

The services to the houses are teed off the distributors by means of aluminium clamps round which bitumen is moulded to prevent any possible corrosion at the joint.

A complete system of telephones has been installed by Messrs. Johnson & Phillips, commencing at a 60-line switchboard in the Exchange, the various instruments being connected through G.I. wires carried on the lighting poles. Instruments are erected in the various offices and factories in the village, and one line is run out to the dam about 5 miles from the village. As the lines are carried on the same poles as the 250-volt lighting distributors, all the instruments and the main board are protected by vacuum spark-gaps, fuses and heat coils.

The whole of this work has been carried out to the instructions of Messrs. Kennedy & Jenkin, the consulting engineers to the Loch Leven Water and Electric Power Co.

Lochgelly Iron and Coal Co., Ltd.

This contract was one for the supply and erection of a three-phase H.T. overhead transmission line, shaft and in-bye cables, and underground switchgear, for the Fife pits of the above company.

The overhead line consisting of three 6/11 copper cables (each cable being laid up on a hemp core) is carried on "A" type wooden poles. The insulators are of the triple-shed type, made of brown glazed porcelain and carried on ¾ in. galvanised steel pins.

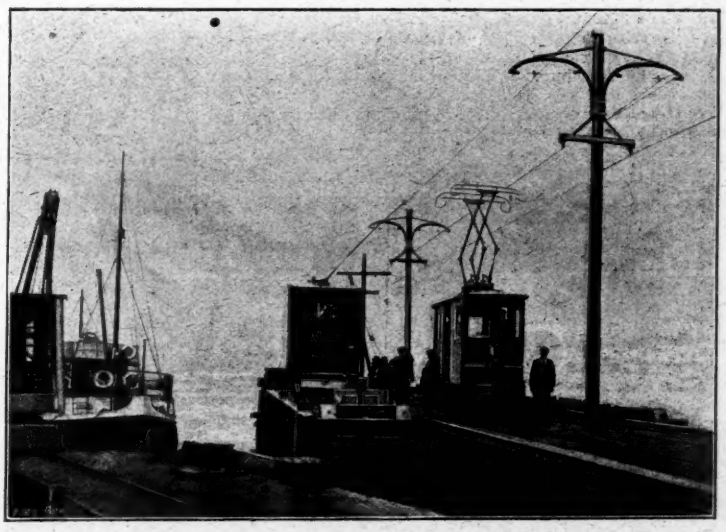
At public roads underground armoured cables are laid, feeding the overhead line each side through trifurcating boxes. At each point where the line is coupled to a cable, a specially designed lightning arrester case is erected on the pole. The case is constructed of galvanised iron, and contains the usual arresters and choke coils, with the addition of isolating switches which come into action when the door of the case is opened, isolating the arrester from the line. A platform is provided in front of the case to provide easy means of inspection.

A 19/18 steel aerial earth wire is run over the H.T. line, and all "earths" are made on to this wire. This earth wire is earthed at about every tenth pole by means of No. 3 copper wire carried down the poles and buried in a pit filled with fine coke.

At points through the yards cradle work has been erected to protect the workmen, and this work calls for special mention. The cradle work is built up of U-shaped spreaders made up from steel rod bent to shape on a suitable former, these being carried on seven No. 19/18 steel cables. One of these spreaders is erected every 3 ft. along the wires, and to further stiffen the work, a 3 ft. 6 in. length of ⅝ in. gas tube is fixed every 6 ft. between the two top steel cables. A very substantial cradle is built up in this way, as can be seen from the illustration appearing on the next page.

The shaft cables for the four pits consist of 3 three-core L.T. cable. Each core is insulated with vulcanised bitumen, the three cores then being laid up and again covered with vulcanised bitumen, the whole being double wire armoured and jute served. These cables are supported in the shafts by means of iron cleats attached to the buntons about every 30 ft. The in-bye cables are built to the same specification, but only single-wire armoured. These cables are supported in the roads by means of rope suspenders.

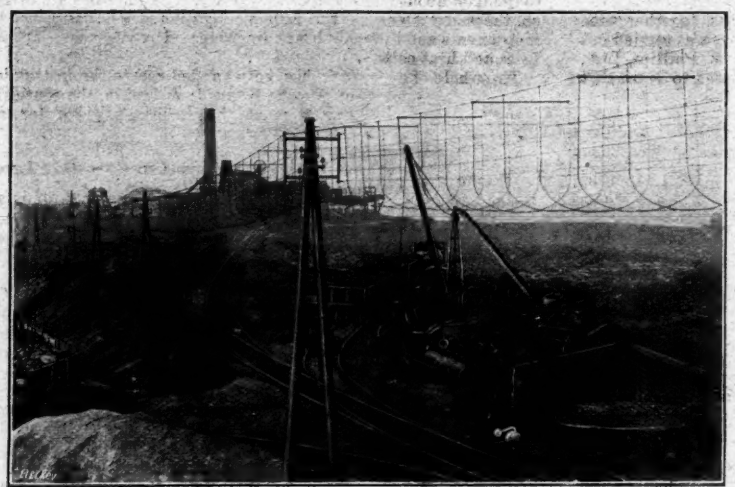
These in-bye cables feed the various switchboards, which have also been supplied and erected by Messrs. Johnson & Phillips, Ltd. These boards are built up with marble panels, and are constructed to comply with the Home Office Rules for this particular class of pit



Kinlochleven.—Overhead Line for Crane and Loco. at Jetty.

All the switches on the boards are of J. & P. oil type, and each board is provided with a J. & P. three-phase low-voltage auto-transformer with plugs arranged for giving from 200 to 224 volts.

The work on this contract was carried out to the instructions of Messrs. James E. Sayers & Caldwell, consulting engineers to the Lochgelly Iron and Coal Co.



LOCHGELLY.—CRADLEWORK ON OVERHEAD LINE.

STORM WATER PUMPING PLANT.

Two interesting installations of pumping plant were also carried out during the year, one for the Portsmouth Corporation at Southsea, and one for the Birmingham Tame and Rea District Drainage Board at Saltley.

The plant in the Southsea Pumping Chamber consists of a switchboard controlling the incoming 500-volt feeders, two main pumping sets, and one auxiliary pumping set. Each main pumping set consists of a 150-H.P. totally-enclosed J. & P. motor, coupled to a Gwynne centrifugal pump. The starting of these sets is quite automatic, each motor being controlled by a motor-driven starter actuated by a float in the sump. These starters were specially designed by Messrs. Johnson & Phillips to meet the requirements of the consulting engineers, Messrs. Bramwell & Harris.

The starting and stopping of the pumps are recorded on special recording apparatus situated in the pumping chamber, and various stations in the town. The outlying recorders are connected to the pumping chamber by means of overhead wires carried on existing telephone poles, or else by underground pilot cables also supplied and laid by Messrs. Johnson & Phillips.

The equipment for the Saltley Pumping House is as follows:—

Messrs. Johnson & Phillips's contract commenced at the meter house of the Aston Corporation, from which current is taken at 6,600 volts three-phase. From this point to the Pump House is a distance of about a mile. For part of the distance power is transmitted through an underground three-core paper cable laid on the solid system, and for the last 1,000 yards through an overhead line consisting of three No. 0 solid H.D. copper wires erected on creosoted wooden poles, a barbed earth wire for protection against lightning being run over the three wires. This line supplies power to the switchboard at 6,600 volts three-phase. This board is of standard J. & P. construction, all the 6,600-volt gear being contained in concrete cells, and the H.T. panels only having L.T. current on them. The 6,600-volt power is transformed down to 2,200 volts for the main pump motors, to 200 volts for the auxiliary pumps, and from 200 to 100 for lighting the pump house by means of Johnson & Phillips transformers. Three 100-KW. single-phase 6,600 to 2,200-volt transformers, one 2,200-volt to 200-volt three-phase transformer, and one 200 to 100 three-phase auto-transformer, are erected under the switchboard gallery for these purposes, all being controlled from various panels on the switchboard. Two main pumping sets have been provided by Messrs. Johnson and Phillips, each consisting of a 55-H.P. 2,200-volt motor coupled to an Allen centrifugal pump; a motor air compressor and a motor sludge pump working at 200 volts, are also provided.

Eight electrically-operated sluice valves have also been supplied. These valves are driven by ½-H.P. three-phase motors. Each motor is connected to the pump house by six overhead lines, the two sets of three lines each being so connected as to drive the motor in opposite directions, thus opening or closing the valves according to the position of the change-over switches mounted on the switchboard in the pump house.

Other large contracts carried out by the firm include the following:—

Cable and arc lamp installation at Avonmouth Dock for the Bristol Corporation; submarine cable contract on the South Coast; tramway cable contract for the L.C.C.; large installation of bare copper mains at Rothesay Dock, Clydebank, for the Clyde Navigation trustees; six 6,600-volt switchgear and machine cable equipments for the L.C.C. tramways; H.T. feeder cable laid for the Grimsby Corporation, and several overhead lines erected in various parts of the country for collieries, &c.

LOCHGELLY.—VIEW OF H.T. OVERHEAD LINE.

LAYING J. & P. SUBMARINE CABLE ON THE SOUTH COAST.

LEGAL.

WIRELESS TELEGRAPH CONTRACT.

THE Lord Chief Justice, the Master of the Rolls, and Lord Justice Buckley, heard an appeal by the plaintiffs in the action of Buitenlandsche Bank, Amsterdam, *v.* Marconi's Wireless Telegraph Co., Ltd., from a judgment of Mr. Justice Bigham, dismissing their action brought to recover damages for alleged breach of contract in connection with the erection of a number of wireless telegraph stations in the Dutch East Indies, and the formation of a company to operate the stations.

MR. HAMILTON, K.C., in support of the appeal, stated that a gentleman named Weiss, who had lived in the Dutch East Indies, conceived the idea that that country afforded a very favourable ground for the application of wireless telegraphy, and he and other gentlemen applied to the Dutch Government for a concession, and also put themselves in communication with the defendant company on the subject. In the autumn of 1906 it was agreed between plaintiffs and defendants, that the former should form a company, under Dutch law, with a share capital of £200,000 for acquiring and working the stations. It was also agreed that defendants should arrange for the erection of 48 stations, and provide working capital

for the venture up to £50,000. The shares of the new company were to be pooled, plaintiffs to have a certain number of them for their services. The concession was dated June 5th, 1907, and by Dutch law £1,000 had to be deposited, and 10 per cent. of the subscribed capital paid up. In January, 1907, the defendant company registered a company called the Sanfil Co., and assigned to that company the benefits they were entitled to under the arrangement. The Sanfil Co. gave a cheque for the £1,000 required as a deposit, but it was alleged that the defendants lent the Sanfil Co. the money to meet the cheque at the bank. Mr. Smith, the secretary to Mr. Cuthbert Hall, the then managing director of the Marconi Co., and a director of the Sanfil Co., subscribed for 600 shares of 1,000 guilders each, and gave a cheque for £5,000, being 10 per cent. on the share capital, which had been then subscribed. That cheque could not be met unless the defendant company placed the amount at the disposal of the Sanfil Co., but as that was not done, the cheque was not met. In the result, the concession was cancelled, and the venture came to nothing. Defendants' case was that they were not under any obligation to plaintiffs until the Dutch East India Co. was formed, and in a position to commence business. They also said that they were entitled to transfer their obligations and benefit under the agreement to any company which they might form to acquire them, and that as they had transferred their benefits and obligations to the Sanfil Co., they were under no liability to the plaintiff bank. Mr. Justice Bigham came to the conclusion that it was not the intention that the defendants should pledge themselves to the Government or to anyone else to equip the stations or to provide the working capital. His Lordship, however, in case the Court of Appeal should take a view different from his as to the liability of the defendants, assessed the damages at £1,000. Mr. Hamilton now contended that the defendant company were not entitled to transfer their obligations without the consent of the plaintiffs.

In the result their Lordships, without calling upon counsel for the defendant company, dismissed the appeal, holding that under the agreement in question there had been an absolute transfer of the benefits of the defendant company to the Sanfil Co., and that Mr. Justice Bigham had properly held that the plaintiffs had not a cause of action against the defendants.

The appeal was, therefore, dismissed with costs.

Parrish and Others *v.* Mexico Electric Tramways, Ltd., and Others.

In the Court of Appeal on Saturday, the Master of the Rolls and Lord Justice Buckley continued the hearing of the defendants' appeal in this action from an order of Mr. Justice Eve on the company to produce certain documents.

The question was whether, as the plaintiff was suing on behalf of himself and all other shareholders of the company, he was in effect the company, and consequently entitled to see documents procured for him and with his money. When the matter was before the Court on Tuesday last, it was mentioned that a decision given over 20 years ago had considerable bearing on the point, but there was no record of it, and the hearing was adjourned for the purpose of procuring the papers in that case, if possible. The papers in that early case were now produced, and the Master of the Rolls complimented the solicitors and thanked them for the prompt production of those documents for the convenience of the Court.

Mr. P. Ogden Lawrence, K.C., who, with Mr. Bruce, argued the case for the plaintiff, said the lease in question in the action was said to have been made for the benefit of everybody, and he contended, upon the evidence, it purported to have been made as much for the benefit of the minority as the majority. That being so, the documents relating to the preparation of that lease were made for the benefit of the plaintiff, and he was entitled to see them.

Mr. Rufus Isaacs, K.C., who with Mr. Stewart Smith, K.C., and Mr. H. Wright, represented the company, was replying, when the Master of the Rolls intimated that he thought it was a case that should be tried by a full Court. The question raised, he said, was one of great legal importance, and affected almost every company. It appeared from papers they had had before them that there was a decision of the Court of Appeal on the matter, but they thought it advisable that the question should be argued by a full Court of Appeal.

It was understood that a full Court would be formed during the ensuing week for the purpose of hearing the appeal.

Municipal Council of Johannesburg *v.* D. Stewart & Co., (1902), Ltd., and the Representatives of the Late Joseph Beardmore.

According to several London newspapers, Lord Mackenzie, in the Edinburgh Court of Session on Saturday last pronounced judgment in this action, in which plaintiffs claimed sums amounting to over £400,000 in respect of the defendants, Stewart & Co., Ltd., having abandoned, and failed to carry out, contracts entered into by them for the installation of gas-producer plant, gas engines, and electrical plant, for the city of Johannesburg, for tramway, lighting and power purposes.

It was pleaded by the defendants, Stewart & Co., that the matter should be dealt with by arbitration, and also that, in terms of their contract, it should be decided by English law and in England. They denied the alleged breach of contract, and stated that the installation was made according to the specification of the plaintiffs, and that any failure of the installation to reach the prescribed tests was due to the unsuitability of coal supplied by the plaintiffs for gas-producing purposes. The defendants, Beardmore, were guarantors for the performance of the contract by the other defendants, their liability being limited to the amount of £115,134 contained in a bond. The plaintiffs sought repayment of the purchase price already paid to Stewart & Co., and about £200,000 as damages for the alleged breach of contract.

The *Standard* says that Lord Mackenzie dismissed the action in so far as it was directed against Mrs. Beardmore, and found that the arbitration clause founded on by the defendants must be construed by the law of England. His Lordship stayed procedure, in order that the parties might carry through arbitration proceedings in England, if on a true construction of the clause it was valid and covered the dispute in question. His Lordship also stayed the action in so far as directed against the defendant, William Beardmore.

Kilner *v.* London United Tramways, Ltd.

Before Mr. Justice Phillimore and a special jury on Monday damages to the tune of £400 were awarded to plaintiff, a glass bottle manufacturer, for personal injuries sustained through a car belonging to defendants colliding with and overturning the London to Dorking coach, in which he was travelling on August 30th, 1907.

PARLIAMENTARY.

Oldham Corporation Bill.

The Bill of the Oldham Corporation, which contains clauses dealing with tramways and the electricity undertaking of the borough, was before Mr. Campion, the Examiner, on Tuesday, for proofs of compliance with Standing Orders, when a number of interesting points were raised. Mr. Cripps appeared for the Yorkshire Electric Power Co., Mr. Pritt for the Lancashire Electric Power Co., and Mr. Anderson for the Corporation.

Mr. Cripps said he would not trouble the Examiner at length, as terms had been arranged between the Corporation and his clients. The terms substantially were that the provisions of the Bill were to be limited so as not to interfere with the rights of the Yorkshire Co. in their area.

Mr. Pritt, for the Lancashire Electric Power Co., said his first allegation had reference to Clause 27, which, shortly, would empower the company to make working agreements with any local authority, company, or person with respect to all or any of their respective tramways and light railways and works connected therewith. He alleged that there was not a word in the notices about light railways. This was a locality where light railways had been constructed, and were likely to be constructed, and those circumstances greatly enlarged the power of the clause. It would enable the Corporation to supply to any light railways in the area of his clients, as well as to tramways, and he contended that this should have been clearly indicated in the notice.

Mr. Anderson said the light railways were virtually tramways. They were laid in the roads like tramways, and equipped exactly the same, and the public would never think of referring to them as light railways. But beyond that the notice said, "To authorise the Corporation and any local authority, body, company, or person, for all or any of the purposes which are incidental to the objects of the intended Act, to enter into and fulfil agreements and contracts." The tramways were the primary object of the Bill and the proposed agreements simply incidental. In the Heckmondwike Bill of 1905 a clause was included empowering the promoters to enter into agreements for the supply of electricity for working tramways and light railways, and not a word was said in the notice in respect of these agreements, nor as to the working of tramways or light railways. The Examiner held, however, that the general words were sufficient to cover these wide powers. In the Hammersmith, City and North-East London Railway Bill of 1905 the question was raised as to notice being given of intention to obtain easements under houses but not under public roads, and the Examiner then said, "I think the agents must be aware that in construing the terms of the public notice the Examiners have always interpreted them in a broader sense than they feel at liberty to construe the more technical documents, and if the terms of the notice are sufficient to put a person of ordinary intelligence on his guard as to what is to be done, that is sufficient." He maintained that everyone must have been put on their guard by the notice given in regard to this Bill.

Mr. Pritt could not agree that all light railways were like tramways. There was no limitation in the clause, and further, light railways might not be laid on roads.

The Examiner: Would you say that the expression with regard to tramways is not sufficiently broad to include tramroads?

Mr. Pritt said he would. A tramroad was a hybrid kind of creature and they hardly knew where it began and ended. In the Heckmondwike case it was a question of supplying electricity outside, but in the present case the point was working agreements. He agreed with the decision in the Hammersmith case, but they had now before them a specific case where the promoters had forgotten to give notice, and had consequently committed a breach of the Standing Orders.

The Examiner said he did not think he laid down any new

doctrine in the Hammersmith case, and with regard to the present case, he considered that the expression "tramways" was sufficient.

The next objection was with regard to Clause 30 which empowers the Corporation to run omnibuses, and to demand and take such reasonable fares and charges for the conveyance of passengers therein as may be approved by the Board of Trade.

Mr. Pritt said this was a new power to the Corporation to levy charges, and it should have been specially mentioned in the notice.

Mr. Anderson submitted that there was no necessity to refer specifically in the notice as to making fares and charges. The primary object was to run motor-omnibuses to act as feeders to the Corporation tramways, and the notice stated that omnibuses were to be run in connection with the tramways over which the Corporation had running powers. The charging of fares was simply incidental. The Cavehill and Whitwell Tramways Bill of 1907 was on all fours with this. There the company took powers to run over the Belfast Corporation tramways, and not a word was said in the notice about fares, but an objection on that point was not sustained.

Mr. Pritt replied that in the Cavehill tramway case there was an existing power to charge, but here it was an entirely new power to take fares.

The allegation was not sustained.

On Clause 46, Mr. Pritt said it provided that if the councils for certain specified urban districts shall be authorised by provisional order to supply electricity, or if any company shall be authorised to supply electricity in any of such districts, the Corporation may enter into and carry into effect agreements with such councils or companies for the supply to them of electricity in bulk. The notice only said authority, and made no mention of company.

Mr. Anderson pointed out that the notice read: "To make further provision with respect to the electric lighting undertaking of the Corporation, and particularly with regard to the supply of electricity in bulk to the neighbouring authorities." To sustain his objection, Mr. Pritt wished to bring in the words "local authority," but it might be the neighbouring distributing authority or the neighbouring authorised authorities.

The Examiner overruled the objection.

Mr. Pritt said his most important objection was in respect of Clause 44, which was a very unusual clause, and read as follows:—"Where the owner or occupier of any premises situate outside the Corporation's area of supply of electrical energy is desirous of obtaining a supply of energy from the Corporation, and is unable to obtain a supply upon reasonable terms from any company, body or person authorised to supply electrical energy in the district in which his premises are situate, the Corporation may, and they are, hereby empowered with the consent of the Board of Trade and of the local authority of the district in which the said premises are situate to give such supply to the said premises on such terms and conditions as may be agreed between the Corporation and the said owner or occupier, and as the Board of Trade may approve." This was not a mere power to supply in bulk, but to supply to consumers individually, and was nothing more than asking for the powers of an electric light provisional order without its obligations. Under Standing Orders a map of the area intended to be supplied should be deposited with the Board of Trade, and further, the area should be defined in the Bill. This was a most important matter to his clients, for without a map they could get no information of what was intended to be done. It was a clause which affected other authorities, as it involved the breaking up of streets.

Mr. Anderson agreed that this was a very important clause. The notice said, "To empower the Corporation to supply electrical energy to premises situated outside the area of supply." How could they know at the present moment who might or who might not be unable to obtain a supply of electricity on reasonable terms, and even if he knew now, six months hence the position of affairs might be altered. For instance, if the Lancashire Power Co. came and offered a supply on reasonable terms he would not be able to supply. The words in the clause were "may" and not "shall," and they were only to be empowered to supply with the consent of the Board of Trade and the local authority. There was no area of supply, and if the Examiner ruled against him no such clause as that could ever come before Parliament.

Mr. Pritt said that in the case of an electric lighting order a map of the area had to be deposited, and there was nothing to prevent the Corporation making up their mind as to the limits of the area within which they would exercise their powers. It was begging the question altogether to say they could not do it.

The Examiner said the arguments upon which the allegation had been supported appeared to be special objections against the powers sought, but they were not objections to the Standing Orders, and therefore he overruled the allegation.

The Bill was ordered to go forward for first reading.

Standing Order Proofs.—At the sitting of the Examiners on Tuesday, the City of Bath Electric Supply Bill and the Somerset and District Electric Power Bill came up for consideration. Memorials alleging non-compliance with Standing Orders had been lodged by the Bristol Corporation, but Mr. Browne stated that the objection would not be proceeded with. The Examiner found that Standing Orders had been complied with in the case of the City of Bath Electric Supply Bill, but, owing to late notices, a non-compliance was returned in the case of the Somerset Bill, and it will be a matter for the Standing Orders Committee as to whether the Bill shall be allowed to proceed.

Private Bills.—It has been decided by the authorities that the following Bills shall originate in the House of Lords in the coming session:—Anglo-Argentine Tramways Co., City of Bath Electric Supply, County of Durham Electric Power Supply, Gateshead and District Tramways, Liverpool Corporation, London United Tramways, North-East London Railway, Oxford and District Tramways, Salford Corporation, Somerset and District Electric Power, Southport and Lytham Tramroad, Torquay and Paignton Tramways, and West Kent Electric Power.

L.B. & S.C.R. ELECTRIFICATION.

In our issue of July 10th last year we gave some particulars of the work which is being carried out on the "South London Line" of this railway.

At the present moment the section from Battersea to East Brixton is completed, and within a couple of weeks the equipment will have been extended as far as Peckham Rye. It is over this section that the experimental running will take place and that the tests will be made in order to verify the very stringent guarantees given by the contractors.

The repair shops and car-sheds are now under construction near Peckham Rye, and it is expected that this work will be completed within the next few months. To these shops will be transferred the telegraph, telephone and other electrical repair works now at New Cross. The supervision and maintenance of the electrical rolling stock, as well as the supervision of the whole of the electrical equipment of the line, will be in the hands of Mr. E. J. Houghton, the electrical superintendent of the London, Brighton and South Coast Railway. It is expected that as soon as the repair shops are completed the whole of the overhead equipment into Victoria and London Bridge Stations will have been carried out; the Brighton Railway Co. will then be in a position to commence running for the public electrically between London Bridge and Victoria.

As is well known, the method of electric traction adopted is the single-phase alternating-current high-pressure system, involving the use of the overhead conductor. This system was decided upon after the most careful consideration, and since its adoption the majority of railway engineers throughout the world have concluded that it is the only satisfactory one for electrically operating any portion of a main-line railway; Herr Geheimrat Wittefeld, the principal adviser and chief engineer to the Prussian Minister of Public Works, who has had experience with both systems of electric traction on the Prussian State Railways, has definitely advised his Government that for future railway electrification the single-phase system is the only one worth considering.

In consequence of the very high pressure at which the current is supplied (6,700 volts) only 100 or 140 amperes are required per train, and the circuit breaker in no case need be set at much over 500 or 600 amperes.

All the high-pressure apparatus on the train, which is of the simplest nature, is enclosed in an entirely fireproof steel compartment, and access to it can only be obtained after the current is cut off and the whole apparatus connected to earth, thereby rendering it absolutely safe. The pressure on every circuit to which it is possible to obtain access whilst current is on, in no case exceeds 300 volts.

Current is collected by means of a collector bow, which is kept pressed against the overhead copper contact wire by means of springs, which are brought into action pneumatically. The contact strips of these bows are composed of aluminium, fitted with grooves filled with heavy grease.

The rolling stock at present constructed consists of eight trains, each made up of three coaches. The two end vehicles are third-class coaches, and each is fitted with four 120-H.P. single-phase Eichberg motors.

Each third-class coach has eight passenger compartments, in which a normal accommodation is provided for seating 66 passengers, but 72 people can be seated without discomfort. The first-class coach comprises nine compartments, and normally seats 56 passengers, but it will easily furnish seating accommodation for 74 passengers. The seating capacity per train is therefore 238 passengers. Ample parcel and umbrella racks are provided for the use of passengers, and all the trains are handsomely upholstered.

A particular feature of the train is the lighting, which is provided by a double circuit of lamps, each compartment being fitted with two Holophane globes, each containing two 10-C.P. lamps, or 40-C.P. to each compartment. By means of this arrangement equal distribution of light is obtained with practically no shadows.

Each coach is fitted with two British-made chemical fire extinguishers and with two oil lamps, so situated as to be easily accessible to the passengers or to the guard in case of emergency. Every precaution has been taken to prevent fire risks.

Each coach is mounted on two pressed-steel bogies with 42-in. wheels and 8-ft. wheel base. The length of the coach is 60 ft. over-all and 41 ft. between bogie centres, the width over-all being 9 ft. Besides ordinary hand brakes, Westinghouse air brakes of the most modern type are installed throughout the train.

It will be seen from the foregoing that everything has been done to provide for the safety and comfort of the passengers, and for the safety of the company's officials.

The whole of the electrical and mechanical equipment has been carried out to the designs and under the direct supervision of Mr. Philip Dawson, M.Inst.C.E., the electrical adviser of the Brighton

Railway Co.; the repair shops, buildings, and switch cabin building were designed by, and carried out under, the supervision of Mr. Charles Morgan, M.Inst.C.E., the company's chief engineer.

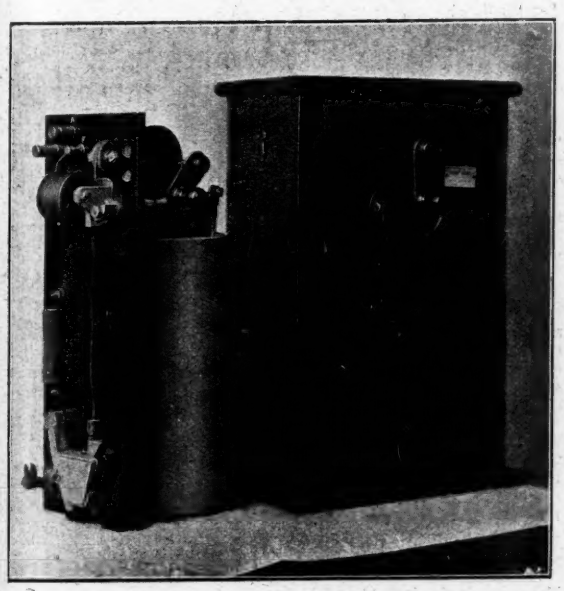
The contractors for the whole work, with the exception of the coaches themselves, are the Allgemeine Elektricitäts Gesellschaft, of Berlin, who were entrusted with the contract in consequence of the very favourable terms, and the very satisfactory guarantees as regards efficiency and operation, put forward by them. It was, however, stipulated by the Brighton Railway Co. that everything that was possible should be of British manufacture, with the result that with the exception of the electrical equipment of the vehicles, all the trains and the whole of the work have been carried out by British workmen and with British material.

The coaches and trucks were manufactured by the Metropolitan Amalgamated Carriage and Wagon Co., of Saltley. The whole of the overhead line equipment and the general electrical equipment of the line, including cables and switchgear, was carried out by Messrs. R. W. Blackwell & Co., who are sub-contractors for this section of the work; the cables were supplied by Messrs. Siemens Bros. and Messrs. Johnson & Phillips, and the switchgear in the switch cabins has been manufactured by the British Thomson-Houston Co., of Rugby.

The electric travelling cranes for the repair shops are being manufactured by Messrs. Stothert & Pitt, of Bath, whilst a special repair and maintenance wagon is being supplied by Messrs. Dick, Kerr & Co.

BUSINESS NOTES.

The O.S. Liquid Motor Starter.—In the accompanying figure we illustrate the patent direct-current liquid motor starter that is being supplied by the O S. LIQUID STARTER Co., of Halsall's Engineering Works, Union Street, Leigh. This is made in five sizes, for motors of 1 to 50 H.P. The special advantages claimed for the design are: Negligible evaporation; gradual acceleration when starting; an absolute no-volt release; immunity from fire and over-heating, and total enclosure. The containers are of the best Doulton stoneware, without joints, and the whole may be



O.S. LIQUID MOTOR STARTER.

taken to pieces on slackening two connections only. It is stated that the electrolyte does not destroy the fittings, and cones have been in use for more than three years, remaining quite clean. A guarantee is given for two years. The starter is adjusted to suit motors of different horse-power within its range by merely changing the electrolyte, the material for which is packed up dry in tins, labelled and graded for the proper current and voltage. When the starter is full on, the resistance is short-circuited.

Book Notices.—*The Universal Electrical Directory* (J. A. Berly's). 1909. London: H. Alabaster, Gatehouse & Co. Price 14s.—This directory has now reached its twenty-eighth year of publication. Each year it has been keeping pace with the progress of electrical application and industry, and every year it has become more essential to the man who wants the addresses of, and some other information concerning, everybody electrical in the United Kingdom, and prominent people on the Continent, in the Colonies, and abroad generally, including the United States. The present edition again bears evidence of the compilers' desire to thoroughly meet the requirements of all classes of the electrical profession and trades. The revision of such an enormous number of addresses is, of course, a matter of great difficulty, but every effort has been made to secure the nearest possible approach to absolute accuracy. For the benefit of those who do not already know the "Red Book," as it has long been called, we may say that it first arranges all British names and addresses alphabetically, classification of these same entries as to professions and trades, following; next there is a geographical section, of which travellers requiring a list of the principal electrical addresses in any particular town make use, and from which they find considerable benefit in convenience and time-saving. Colonial and general foreign alphabetical and classified sections, both so necessary when British electrical trade is being developed abroad, come next in order, and they are followed immediately by Continental alphabetical and classified departments, also of considerable service when greater attention is being given, and promises to be still more so, to the pushing of British electrical manufactures on the European Continent. The United States, in two sections as in all other cases, comes at the end. The starting point of each section is plainly indicated by means of a thumb index. There are other things in the book as well for the benefit of those who want to know something about the *personnel* of the Institution executive and some other bodies, but two features that are particularly useful from a trade point of view, are the list of "Specialities (electrical)" where many manufactures are classified according to the registered or trade name of the article, followed by the names and address of the manufacturer or agent. This is a section which might be amplified with advantage. The lists of electricity works, &c., at home and abroad, giving particulars as to the system of supply, voltage, &c., form the other feature, the existence of which has not so far been known so widely as it should, or the editors of the ELECTRICAL REVIEW would have fewer inquiries over the telephone asking what the voltage at such and such a foreign city is.

"*Practical Engineer*" *Electrical Pocket-Book and Diary*. 1909. London: The Technical Publishing Co. Price 1s. net.—In this year's edition the sections on magnets, dynamo design, &c., have been revised and partly rewritten by Mr. C. C. Hawkins; various other sections have been revised and extended, such as those dealing with instruments, lamps and switchgear. Apart from occasional misprints—such as the use of "michroms" for microhms, pp. 25 and 29, Bastain for Bastian, Ottis for Otis, &c., and a tendency to include particulars relating to obsolete apparatus—such as the old Brush lamp—we find the contents generally correct and up to date, and the book should be much appreciated by its users.

L'Année Electrique, Electrothérapique et Radiographique. By Dr. F. de Courmelles. Paris: Ch. Béranger. 1909. Price 3.50 fr.—Dr. Courmelles's annual review of electrical progress, now in its ninth year, as usual covers the whole field of electrical interest, and constitutes a convenient summary of the new discoveries and applications of, or connected with, electricity in 1908. Without going into details, the author gives a rapid sketch of each subject, clear and concise. Naturally, nearly half the book is devoted to medical and allied matters.

Horse-Power Computers. By H. A. Golding. London: Chas. Griffin & Co., Ltd. For the steam engine, price 5s.; for petrol motors, price 6d.—These are cardboard mechanical calculators of the disk type, ingeniously arranged so as to facilitate the solution of numerous problems connected with engines, and are patented by the author. They are accompanied by explanatory pamphlets. The steam engine calculator consists of four concentric disks, carrying some eight logarithmic scales representing boiler pressure, speed, size of cylinders, R.P.M., &c., the use of which is illustrated by a large number of worked examples. One of the special advantages claimed for the instrument as compared with the slide rule is that there is never any doubt as to the position of the decimal point in the result. It can also be used for gas and oil engines, and for single-acting steam engines. The petrol motor computer is much less complex, consisting only of two disks, carrying four scales, which suffice for computations in accordance with the R.A.C. rating, H.P. $= d^2 \times n/2{\cdot}5$, where d is the diameter of the cylinder (in inches or mm., two scales being provided) and n is the number of cylinders. The instruments are neatly printed on varnished card, and should be found of great value to users.

Spons' Architects' and Builders' Pocket Price Book. 1909. London: E. & F. N. Spon. Price 3s. net.—This is the thirty-sixth edition of a work which is so well known and approved as to be independent of commendation. Edited by Mr. Clyde Young, it has been revised by Mr. Stanford M. Brooks, and has been entirely recast in a handy pocket form, measuring 6½ × 3¾ in., with 550 pages of thin paper. Besides the useful features of previous editions, much new matter has been embodied in the present issue, relating to such subjects as reinforced concrete, fire-resisting construction, cold storage, &c. The memoranda are arranged in alphabetical order, saving the necessity of an index to this section. The price-book section is arranged in the usual order of a bill of quantities, the prices being based on work recently carried out, and is provided with an index.

"Journal of the American Society of Mechanical Engineers." January, 1909. Also the "A.S.M.E. Year-Book, 1909." Baltimore, U.S.A.: The Society.

Bankruptcy Proceedings.—ELIE HINTON.—A sitting of the London Bankruptcy Court was held on Thursday last week before Mr. Registrar Hope for the public examination of Elie Hinton, described as a director of public companies, residing at 5, St. Mary's Terrace, Paddington. The accounts showed liabilities £2,851, and assets £695. Questioned by Mr. G. W. Chapman, Official Receiver, the debtor stated that he was formerly a partner in a firm of electrical engineers, whose business was converted into a company with a nominal capital of £55,000. As joint vendor he received £2,500 shares, and was appointed a director at a salary of £400 per annum. At the end of 1907, however, he became a

nominal director only, at a reduced salary of £60 per annum, but had resigned office in consequence of these proceedings. He had been a director and had assisted in the promotion of several other public companies, including the Granville Club Syndicate, Ltd., which was registered in February, 1906, with a nominal capital of £20,000, and was carried on at 16, Hanover Square, W., until March, 1908, when a compulsory winding-up order was made. Witness attributed his insolvency to loss through the failure of the Granville Club, to loss in connection with the working of a patent, and to other company losses. The examination was ordered to be concluded.

20s. in the £ + 4 %.—Edward Percival Oliver, electrical engineer, 50, Great Sutton Street, Goswell Road (Newington, Priddle & Co.).—A first and final dividend of 20s. and 4 per cent. interest is payable any day between 11 and 2 at Bankruptcy Buildings, Carey Street, W.C.

R. Russell (R. Russell & Co., electrical engineers, Putney).—A receiving order was made at Wandsworth on January 28th on a creditor's petition. The first meeting is to be held on February 10th, and the public examination on February 18th.

A Manchester Exhibition Building to be Erected.—It will be remembered that the absence of a suitable building in Manchester was one of the greatest difficulties that had to be met by the Committee of the Electrical Exhibition that was held there last year. It is now felt that such an Exhibition Building, if erected, would be practically certain to be a successful undertaking, especially bearing in mind the proposal to hold an Engineering Exhibition in Manchester next year, and that many Trade Exhibitions are organised from time to time in that city. A company has therefore been formed to carry the idea into effect, and we understand that contracts are being arranged. The secretary of the company is Mr. Peter Gregson, of 44, Brown Street, Manchester, and the London offices will be at 2, Queen Anne's Gate, Westminster, where Mr. C. S. Northcote will be glad to furnish particulars of the scheme to any reader.

Callender's Hospital Fund.—We have received a copy of the sixth annual report and accounts of Callender's Hospital and Distress Fund, which were approved at the general meeting held at Erith on January 30th, with Mr. T. O. Callendor in the chair. The 1d. a week subscriptions realised £183 (against £180), and there were donations from the firm and the directors personally, to the tune of £72. The amount paid out in gratuities to members was £58, and £209 was distributed in grants to hospitals, &c. The balance at bank and in hand is £70, as compared with £86 a year ago.

Catalogues and Lists.—The Sun Electrical Co., Ltd., 118/120, Charing Cross Road, W.C.—Leaflet giving particulars and prices of their aluminium lampholder, also of the "Automat" lampholder.

Morley Electrical Engineering Co., Ltd., Troy Works, Stanningley, near Leeds.—New catalogue of 32 pages art paper containing a number of excellent half-tone illustrations and descriptions of main, main and tail, endless and portable haulage gear, electric trolley hoists, warehouse friction cranes, hand and electric overhead travelling cranes, electrical transporters and overhead runways.

The Union Electric Co., Ltd., Park Street, Southwark, S.E.—Two new lists relating to the latest improvement in their "Excello" arc lamps. A new deposit free cover is introduced eliminating the difficulty due to the more or less rapid deposit of the products of combustion upon the interior surface of the globe, which, even during quite short periods of burning the lamps, gradually decreased the effective illuminative. Minor improvements are embodied, such as a draughtless ash-tray, protecting the arc against the effect of constant intermittent wind pressure, the subdivision of the sleeve simplifying the trimming, &c. Particulars of the foregoing are given in list No. 5,007. No. 5,009 relates to the "Improved Union Excello" intense flame lamp, and announces considerable reductions in prices to meet the present demand for a low-priced lamp; it also gives prices and details of accessories, such as line resistances, transformers, hoisting gear, &c.

Messrs. Siemens Bros. & Co., Ltd., Queen Anne's Chambers, Broadway, Westminster.—New pamphlet No. 514, containing an excellently-produced description, with half-tones and diagrams, of the Hopkinson-Thring patent torsion meter, which is made at the firm's Woolwich works, and can be seen by appointment. Particulars and illustrations of this device appeared in our last week's article on "Some Siemens Electrical and Other Instruments."

Armorduct Manufacturing Co, Ltd., Farringdon Avenue, E.C.—Folding pamphlet for consumers, showing them how electricity with the "Gral" lamp is cheaper than gas. The firm will supply *bonâ fide* contractors with a number of the lists specially printed with their own name and address.

Messrs. Ernest Scott & Mountain, Ltd., Newcastle-on-Tyne.—This is a fully illustrated catalogue of some 50 pages devoted to the firm's "Esco" electrical mining specialities. A number of photographic views of different departments at the works at Gateshead lead off, and a number of others follow showing various examples of power house equipments supplied by them for colliery service. Next come switchboards and switches, pumping machinery, haulage and winding gear, miscellaneous equipment, switch-work for mining purposes, and after these are published a number of useful tables and notes relating to sizes and carrying capacity of cables, possible speeds of three-phase machines, mechanical transmission of power, water formulæ, and horse-power required for haulages. Finally, we have a very satisfactory list, occupying three double-column pages, of colliery-owners with whom Messrs. Scott & Mountain have done business during the last 20 years.

The Sunbeam Lamp Co., Ltd., Park Road, Gateshead.—Lists announcing reduced prices of Sunbeam metal-filament and carbon lamps, also a new price list of electric lighting accessories, adaptors, lampholders, cut-outs, and so on.

Messrs. Everett, Edgcumbe & Co., Ltd., Collindale Works, Hendon.—Calendar for the current year with monthly tear-off date sheets, one-half the dates appearing on either side of Shakespearean quotations which look suspiciously like having been written by the Bard to especially bear on the firm's manufactures.

British Insulated and Helsby Cables, Ltd., Prescot.—New catalogue (No. P. 83) giving particulars with excellent half-tone illustrations and connection diagrams and tabulated dimensions, of the Prescot low-tension tubular switch-fuses.

For Sale.—Messrs. Thos. W. Ward, Ltd., of Albion Works, Sheffield, are offering for sale various steam boiler, engine and electrical plant, at the Powick Electricity Works, Worcester. Particulars will be found among our advertisements to-day.

On Monday, February 15th, Messrs. Mountain, Sons & Co., will offer for sale by auction the plant, stock-in-trade, fixtures, &c., of Cutler, Wardle & Co., Ltd. (in voluntary liquidation), of Manchester. Some details appear among our advertisements.

The Brescia International Electrical Exhibition.—The *Board of Trade Journal* says that a Committee in Milan, and another in Brescia, will co-operate with the object of rendering this exhibition a success. The scope of the exhibition will comprise the historical and statistical aspect of the electrical industry; hydro-electrical installations; electric motors, generators and transformers; measuring instruments, conductors, insulators, insulator supports; electric lighting; electric traction; electro-chemistry, &c. Applications for space must be sent in by February 28th. A copy of the programme and regulations (in Italian) may be consulted at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

The Jandus Regenerative Flame Arc Lamp.—Referring to our article in a recent issue of the Review on the drawbacks to the more extensive use of flame arc lamps, the Jandus Arc Lamp and Electric Co., Ltd., write to say that they cordially agree with us as to the need for the elimination of the many weak designs at present on the market. Regarding our remark that so far as we were aware, there was not any flame lamp on the market that would feed for 34 hours with only one break, they point out that the Jandus regenerative lamp, which has now been on the market for nearly a year, and is in use by 27 corporations, as well as many other large consumers, satisfactorily fulfils our conditions for a better lamp. The burning hours vary from 70 to 90 hours, according to the type of lamp, &c., and this length of burning is obtained with *one pair of carbons*, which may feed right through without any break. The longest carbon is 18 in., and of large cross section, viz., ⅝ in. diameter, and this reduction of carbon length results in a short lamp with an overall length of only 36 in. The arc is completely enclosed, and no fumes can escape; their patents cover arrangements whereby the fumes are prevented from obscuring the globe. In consequence of the enclosure of the carbons, the working parts are quite protected from deterioration caused by the fumes. The mechanism is also of a simple and substantial type, with an entire absence of clockwork and similar small gear. They add that the inhalation of the calcium fumes used for the ordinary yellow carbons, and more particularly of the fumes from the barium salts generally used for the white light carbons, may cause, and has caused, serious poisoning troubles with open-type lamps burned in a confined atmosphere. Luckily, the first symptom is headache and giddiness, but for indoor use there is no doubt that an enclosed type of lamp is preferable.

Trade Announcements.—Owing to the expansion of their business, The Linolite Co. are providing larger works for the manufacture of "Tubolite." They have therefore purchased the freehold of ¾ acre of land at South Acton, and the existing buildings have been re-arranged and adapted to the firm's requirements, so as to ensure the comfort of the workmen and afford adequate provision for dealing with the increasing output.

The British Electrical Trade Supply and Bitumen Co., of Trundley Road, Deptford, S.E., announce that Mr. H. H. Bishop is not now connected with them. Mr. A. E. H. Dussek, who will be calling upon buyers in London and the South, has visited Trinidad, and is therefore fully informed regarding Trinidad bitumen, compounds, &c.

Mr. David Shanks has been appointed managing director of Messrs. David Shanks & Co., Ltd., manufacturers of electric light fittings and art metal work, which firm has erected new works with modern equipment at Manor Works, Albert Road, Aston, Birmingham. Mr. Shanks formerly acted in a similar capacity for Messrs. H. W. Sambidge & Son, Ltd., who recently ceased business.

Mr. Walter Robb, electric lighting, power and telephone engineer, has opened premises at 11, Drury Lane, Wakefield.

Dissolutions and Liquidations.—Engineering Instruments, Ltd.—A petition for winding up this company has been presented by Messrs. Davis & Timmins, and it is to be heard on February 9th.

Electro-Medical Institute, Ltd.—A petition for winding up this company is to be heard at Salford on February 12th.

Messrs. Lund Bros. & Co., electrical and mechanical engineers, 78 and 80, Queen Victoria Street, E.C.—Mr. J. H. Arneveld retired from this firm as from February 29th, 1908. The firm will in future consist of Messrs. Richard Lund and F. C. Polden only, who will attend to debts and carry on the business under the same trade name at the same address.

Zircon Syndicate, Ltd.—This company is winding up voluntarily with Mr. G. F. Stevens, 24 Budge Row, E.C., as liquidator. A meeting of creditors will be held on February 10th.

London Electric Wire Co., Ltd.—At meetings held at Playhouse Yard, Golden Lane, London, on December 30th and January 29th, it was resolved "that it was desirable to reconstruct the company and accordingly that the company be wound up voluntarily."

LIGHTING and POWER NOTES.

Aberdeen.—The controversy over municipal trading affecting electrical contractors in Aberdeen reached a head at a meeting of the Electricity Sub-Committee of the T.C. on Wednesday last week, when local contractors declined to give their support to the proposed electrical exhibition in the spring. The discussion lasted two hours, the contractors attending on the invitation of the Sub-Committee. They stated, however, that they thought the exhibition was likely to do little good so long as the price of electricity remained as high as it is in Aberdeen, and that until there was a considerable reduction in the price, electricity could never compete with gas, either for heating or power purposes.

Acton. — Our local correspondent writes: — "The electricity undertaking of the Acton U.D.C. appears to be passing through a critical stage. The electric lighting order for the district was obtained in 1891, but remained in practical obeyance until the the year 1903, when the B. of T. insisted upon some active steps being taken, and, as a result, the Council entered into an agreement with the Metropolitan Electric Supply Co., Ltd., for the supply of electricity in bulk from the company's works at North Acton to a transforming station erected by the Council, and Mr. J. Martin Blair was appointed resident electrical engineer. In four years the Council has secured over a thousand consumers, which led to a remark by Councillor R. Poulton, the 'Father' of the Council, at a recent meeting, that 'he personally considered the concern was a grand success.' Unfortunately, however, there are other members of the Council who share a distinctly opposite opinion, and seemingly take a delight in opposing the scheme whenever they consider opportunity presents itself. The chairman of the committee, responsible for the oversight of the department, describes the undertaking as 'a white elephant,' and urges the Council to dispose of it. The vice-chairman also speaks disparagingly of the concern in public; while the chairman of the Works Committee urges that the services of the electrical engineer are no longer necessary, and agitates for his resignation or dismissal. Again, the Council as a body, unheeding the chairman's advice, recently decided to help a competitor by entering into a contract with the Brentford Gas Co. for the lighting of the new dust destructor buildings which adjoin the electricity works. Perhaps the one satisfactory feature is that up to the present the foregoing attitude has not resulted in any diminution of the 'custom' by local traders and private houses. It is unreasonable for any Councillor to continue making attacks of a personal character on the engineer and members of his staff. Three months hence the Council will be able to ascertain exactly the result of the present financial year's working of the undertaking. A month ago the chairman of the Finance Committee said that the Council had over-estimated the deficiency."

Bath.—In view of the opposition of the B. of T. to the proposed sale of the Corporation electrical undertaking, it is recommended that the T.C. shall rescind the agreement with Mr. Schenk, and, if necessary, oppose the City of Bath Electric Supply and the Somerset and District Electric Power Bills, should they come before Parliament.

Birmingham.—The Electric Supply Committee has decided to reduce the price of energy for power and private uses, as from March next. The rates for H.T. supply were recently revised.

Bridlington.—The T.C. has decided to apply to the L.G.B. for a loan of £4,400—for condensing plant, £1,500; meters, £400; Tirrill regulator, £200; mains, £1,200; services, £800; miscellaneous, £300.

Brighton.—A special report by Mr. Arthur Wright, consulting engineer to the T.C., dealing with the purchase of additional plant for the Southwick works, at a cost of £15,000, has been under consideration. With one dissentient, the Lighting Committee recommends the T.C. to adopt the proposal.

Church (Lancs.).—The U.D.C., after conferring with representatives of Clayton-le-Moors U.D.C. respecting the E.L. scheme to be carried out by Accrington T.C., has agreed to a stipulation that either U.D.C. may at the end of 14 or 21 years, or at the end of any subsequent seven years, take over the undertaking on payment of the cost of constructing the mains, works and appliances in their respective districts, less a reasonable sum for depreciation, and without any allowance for profits, compulsory sale, or any other consideration.

Continental Notes.— Belgium.— La Société Electricité du Nord de la Belgique is the name of a new company which has just been formed in Brussels, with a capital of £66,000, to establish central electric lighting stations and electric tramways in North Belgium. The Banque de Bruxelles and the Compagnie Générale Belge d'Entreprises Electriques are among the concerns interested in the new undertaking.

France.—The Société des Grands Travaux de Marseille has applied for leave to establish a weir across the River Drôme at Châteauneuf d'Izère, raising the water-level from 7 to 10 metres, and to construct on the right bank a canal to supply a hydro-electric station to be set up at Beaumont-Montaux for the distribution of electric energy.

Italy.—The two companies supplying Naples with electricity have been amalgamated and the capital raised to 16 million francs. The new company possesses several water power concessions, and proposes to derive a supply of 3,750 H.P. from a fall on the River Lété.

Devonport.—It is reported at Devonport Dockyard that the economy and convenience of the electric light for ship repairs have now been well established. Formerly steam had to be kept up in at least one boiler to run the dynamos for lighting the ship, so that work might be carried out in the remote parts of the vessel, as the number of sets of mobile electric plant kept at the yards was often far from sufficient to light up every ship under repair. In this state of affairs, repairs to the electric installations, which should have been thorough while the ships were in Dockyard hands, were often hurried or passed over altogether, with consequent inconvenience and breakdowns when the vessel again put to sea. With electrical power stations at each yard, however, these difficulties are overcome by connecting any part of the ship's installation with the shore system.

Dover.—The T.C. has decided to apply to the L.G.B. for a loan of £3,000 for E.L. purposes. Of this sum about £2,000 has already been spent on mains extensions.

Dumfries.— The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., intends to transfer to the Dumfries Electricity Supply Co., the undertaking authorised by the Electric Supply Order, 1899. The pecuniary consideration is the sum of £34,250 "to be paid and satisfied by the allotment to the India-Rubber Co. of 34,250 fully-paid shares of the Dumfries Co. of £1 each."

Gloucester.—The T.C. has reduced the price of energy supplied to Messrs. Priday, Metford & Co., Ltd., to a flat rate of 2d. per unit when the quantity consumed in a year amounts to 8,000 units. A similar rate has been fixed for the supply to the King's Theatre when the yearly consumption amounts to 10,000 units.

Hanwell.—The U.D.C. is considering the advisability of transferring the E.L. order to the Brentford Gas Co.

Heysham.—The B. of Trade has asked the U.D.C. what steps are being taken to carry out the E.L. order of 1904.

Heywood.—Mr. H. R. Hooper, of the L.G.B., held an inquiry on Thursday, last week, relative to the T.C.'s application for sanction to borrow £16,000 for electricity purposes. There was no opposition.

Hindhead.—The Electric Lighting Co. has agreed to a clause being included in the provisional order, embodying the recommendation made by the Farnham R.D.C., as to the supply of electricity to Frensham within five years.

Hull.—The estimated receipts of the Corporation electric lighting and power undertaking for the coming year are £52,788 as against £54,387 for the year 1908-9, and it is estimated there will be a balance of £1,508 as against £2,021. The decrease in the estimated receipts is due to the extended use of high-efficiency lamps, and the only way of counteracting this is to secure additional power consumers, a course the engineer will adopt.

The E.L. Committee has advised the Corporation that, in order to carry out the proposed electricity scheme at Hessle, it was desirable that the Hessle U.D.C.'s prov. order should be transferred to the Corporation. The capital cost is estimated at £15,000, and on the first year or two's working a loss of £561 is estimated. After that the scheme will probably show a small profit. The matter stands deferred for further consideration.

Letchworth.—According to the report presented to the annual meeting of the First Garden City, Ltd., held last week, there was a loss of £85 15s. 10d. on the year on the company's electric power station. It is stated, however, that "the station has proved itself very efficient; while the low prices charged for current compare favourably with other industrial towns, and are assisting to attract smaller industries, a direct profit on this service cannot be expected for the present. The efficiency of the waterworks has been increased by the duplication of the pumping plant. This is now mainly driven from the electric power station."

Leyton.—The engineer has reported on the success of 24 Oliver flame arcs, erected in the High Road last autumn; he proposes to replace 45 remaining open-type lamps by flame arcs.

London.—Fulham.—The B.C. has had under consideration the advisability of providing rising mains in maisonettes, with a view to encouraging the use of electricity. The practice has been to provide rising mains in blocks of flats, on condition that the stairways are electrically lighted, the main terminal fuse-boxes being fitted near the entrances to the flats. In maisonettes the rising mains would cost some 25s., in addition to the ordinary service costing some £7, but the possible income would be doubled. The Council is to undertake this work.

The Electricity Committee has had under consideration the expediency of henceforth waiving the minimum charge of £1 per annum which is made for heating and motive power purposes. This charge appears to create a certain amount of dissatisfaction amongst small consumers, and it has now been provisionally decided that no minimum charge shall be made in future with respect to energy supplied for heating or power purposes.

SOUTHWARK.—The L.C.C. has approved of the borrowing by the B.C. of £8,500 for electricity purposes:—£4,586 for mains, to be repaid within 30 years; £1,525 for plant, within 20 years; £1,313 for house services, 12 years; and £1,076 for meters, in 10 years. The B.C. is urged to establish an adequate reserve fund.

METROPOLITAN ASYLUMS BOARD.—The Board has agreed to pay £200 compensation to the South Metropolitan Electric Tramways and Lighting Co., in respect of the delay in making use of the electricity supply furnished by agreement to the Southern Hospital at Carshalton.

HAMPSTEAD.—The B.C. is to fix underfeed stokers to the eight boilers in the north boiler house at the electric lighting station, at a cost of £2,050. The provision of these stokers will, it is thought, result in a saving of £1,700 a year, as they will make it possible to use slack instead of Welsh coal.

MARYLEBONE.—The September quarter's revenue account of the electricity undertaking was presented to the B.C. at its meeting on January 14th. The total expenditure chargeable against the account amounts to £10,173, compared with £11 865 for the corresponding quarter of 1907, a reduction of £1,692. Concurrently with this reduction there has been an increase in sales, so that the improvement in costs is even greater than the figures indicate. The total costs per unit sold work out at 1·767d., compared with 2·135d. in the corresponding quarter, an improvement of 17 per cent.

Maidenhead.—The T.C. has adopted a recommendation of the Electric Light Committee that a distributing main should be laid to Braywick at a cost of £900, upon satisfactory guarantees (already promised) amounting to £149 per annum for the first two years, and £129 for the third year being first entered into, also that the sum of £2,000, balance of the loan of £4,407 authorised by the L.G.B., be now taken up.

Merthyr Tydfil.—The B. of G., after considering the advisability of lighting the workhouse and infirmary by electricity, has instructed Mr. Lloyd, electrician at the Dowlais Works, to prepare a report upon the matter.

Morley.—Mr. H. R. Hooper held an inquiry on Wednesday, last week, into the application of the T.C. for sanction to borrow £11,759 for the purposes of the electricity undertaking. Of this amount, £7,942 was required for generating plant and switchboard for the new tramway load.

Newport (Mon.).—It was reported at the meeting of the Finance Committee of the Corporation, that probably there would be no deficit in the electrical account this year. Last year there was a deficit of £2,864.

North British Power Syndicate.—A conference of the Scottish Municipal Authorities was held in Glasgow on Wednesday, last week, regarding the proposals of the North British Electrical Power Syndicate, Ltd., all the leading municipal supplies being represented.

Rhondda.—The Penygraig Chamber of Trade have approached the Porth Chamber of Trade with a view to a joint request to the Rhondda Tramway Co., Ltd., to apply for powers to provide electric light and power in the two Rhondda Valleys.

Salford.—Councillor W. H. Barrett has resigned the chairmanship of the Salford Electricity Committee. The reason is not stated. It is surmised, however, that differences of opinion on important questions which have been before the Committee recently, may have led Mr. Barrett to take this step. The settlement of contracts with consumers without reporting the terms is one of those questions. The Council has yet to receive the report of a special Committee appointed to consider it. Energy is to be supplied at a reduced price to the new Nurses' Home in connection with the Salford Royal Hospital; the present average consumption is 15,000 units per annum, and it is estimated that this quantity will now be increased to 22,000 or 24,000 units. The Electricity Committee has decided that Wilburn Street depôt is the best available site for the proposed new generating station, and considers that the offer of the Lighting and Cleansing Committee to transfer the site for £25,000 is reasonable.

South Africa.—PORT ELIZABETH.—The smoke stack of the tramways electric power station collapsed on the evening of December 28th and disorganised the service. Owing to the absence of draught the plant was unable to work.

DURBAN.—Owing to the extensive use of metallic-filament lamps for business premises, the energy consumption for the month of December last was less than in any December month since 1904, notwithstanding the largely increased number of consumers.

A scheme is on foot for the erection of a power transmission scheme from Howick Falls, about twelve miles from Pietermaritzburg. The scheme includes the construction of a blanket factory for the manufacture of Kafir blankets, on which there is a duty of 40 per cent. It is hoped to float the company in Natal with a capital of about £60,000. It is also proposed to supply power and light to Maritzburg.

Stockport.—A heated discussion took place on Tuesday at the B. of G., relative to a resolution which had been remitted for reconsideration at a previous meeting of the Board, to engage an outside engineer to carry out alterations to the electric lighting at Stepping Hill Hospital. Several Guardians had contended that the electrical engineer of the Stockport Corporation ought to be employed to supervise the work. The Committee, however, declined to alter its decision. It was decided to advertise for tenders and to employ Mr. H. H. Barber to supervise the work.

U.S.A.—On January 1st, 1909, the New York Edison Co. had connected to its system a load of 6,805,991 16-C.P. equivalents. This load was divided as follows: 3,480,719 incandescent lamps, 32,516 arc lamps, 1,106 vapour arc lamps, 1,103 KW. in heating apparatus, 4,430 KW. in storage batteries and 205,373 H.P. in electric motors.—*Electrical World.*

Wednesbury.—The sanction of the L.G.B. has been obtained by the T.C. for borrowing £800 for the purpose of using the tramway poles for carrying wires for electric lighting purposes. The Tramways Co., however, although the consent of the B. of T. has been obtained, refuses to give facilities to the T.C. for so using the poles unless the Corporation pays the company £380, and enters into various indemnities. The Lighting Committee of the Corporation therefore recommends to the Council that cables be laid underground, and that application be made to the L.G.B. to annul the sanction for £800 already obtained, and that a further application be made to the Board for sanction to borrow £1,700 for the work.

Windsor.—Electric motors have been installed at the Windsor Castle Sewage Works (Old Windsor) to take the place of the steam engines hitherto used there, and electric motors are also being installed in the Office of Works Department at the Castle.

Worthing.—Acting on a report by its resident engineer, Mr. G. Porter, the T.C. has decided to apply to the L.G.B. for sanction to a further loan of £3,900 for electric lighting purposes. Of this sum, £1,600 is wanted immediately for two additional feeder cables, and the remainder is made up of prospective requirements in the way of meters, house services and distributing mains during the next two years.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—At a meeting of the Tramways Committee it was reported that the recent snowstorm cost the department £700, of which £470 had been loss in traffic receipts. Fortunately there had since been an increase that wiped out the loss. Mr. Pilcher, the manager, and his staff were complimented on their work during the storm.

Barnet.—The Herts. C.C. has leased the Barnet tramways to the Metropolitan Electric Tramways, Ltd., on payment of a fixed rent of £5 per cent. per annum upon the outlay by the C.C.

Blackburn.—A report presented to the T.C. this week as to the working of the electric tramways for the last nine months shows a greatly reduced profit, as the following comparisons will show:—1908, £905 profit; 1907, £3,365; 1906, £1,726; and 1905, £1,073. On the revenue account the income was £48,367, equal to an average of 12 37d. per car-mile, and the traffic receipts came to £46,580, equal to 11 92d. The working expenses came to £31,325, equal to 8·01d. per mile. Traffic expenses amounted to £11,206. Power expenses (cost of energy at per B. of T. unit) amounted to 1⅛d., or £9,349.

The extensions to the electric tramway system were inspected by Lieut.-Col. E. Druitt, of the B. of T., on January 28th and passed; the same day service was inaugurated. There has been a protracted meeting of the Tramways Committee, the question of raising the fares on the Boston Road section and the discontinuance of the through service to Cherry Tree during certani parts of the day being discussed. Eventually, increased fares and a curtailed service to Cherry Tree were decided upon.

Canada.—It is stated that the Canadian-Pacific Railway, as the result of investigation of the available water-power in the Rocky Mountains, has decided to electrify certain mountain sections, and this, in spite of the fact that coal is abundant.

Continental Notes.—ITALY.—The *Giornale dei Lavori Publici* states that a Belgian company has instructed Engineer Pfaltz to make the surveys for two new electric lines, one direct from Como to Milan, along the western bank of the lake, and the second from Como to Argegno. This line may be eventually extended to Chiavenna.

A scheme has been framed for the construction of an electric tramway, 50 km. long, to connect the towns of Biella, Cavaglia, Cigliano and Chivasso.

SWITZERLAND.—The Federal Council has granted a concession for the construction of an electric mountain railway from Gletsch by Andermatt to Disentis. The cost of construction is estimated at about 14,000,000 fr.

The draft scheme for a new electric line uniting Lugano, Bioggio, Sorengo, Agnoponte, Tresaponte and Cremenaga has been distributed among the members of the Federal Council of the Canton of Ticino. The line will have a length of 22 km.

Austria.—The T.C. of Vienna, says *Der Elektrotechniker*, is considering a plan for the utilisation of the water power in the Valley of the Enn for the supply of electrical energy for industrial purposes to Vienna. A transmission line 150 km. long will conduct the current to Vienna. The power will be derived partly from the natural falls of the Enn and partly from a reservoir. The estimated costs of the scheme are placed at between 50 and 60 million kronen.

Turkey.—It is stated that a group of Turkish capitalists has promoted a company with a view to building an electric tramway from Jaffa to Jerusalem, and supplying electricity in the latter place.

Roumania.—The municipal authorities of Ploessi have decided to arrange for the construction of an electric tramway in the town.

A syndicate has been formed with a capital of 15,000,000 fr., for the purpose of constructing an electric tramway system in Bucharest.

Russia.—The granting of a 42 years' concession for the construction and working of 10 lines of electric street tramways is contemplated by the T.C. of Baku. The lines will have a total length of 34 miles.

Germany.—The electric railway from Düsseldorf to Crefeld having proved a profitable undertaking, the Renischer Bahngesellschaft has decided to carry out an extension from the former town to M. Gladbach, passing through Neusserfurth and Schiefbahn. A line is also to be constructed to Schiefbahn from Crefeld, passing through Willich.

Dudley.—The Corporation proposes provisionally to insure the tramcars and depôt purchased from the tramway company for the sum of £10,000.

Falkirk.—The extension of the tramways to Laurieston is to be proceeded with at once, and the contracts have been placed. The new line will join the present system at the west end of High Street, and continue through that thoroughfare and along Callendar Road to Laurieston. The cause of delay has been the necessity of extensive street widening.

Glasgow.—At the T.C. meeting it was intimated by the convener that the tramways department had just finished 70 top-covered cars, and now asked for permission to cover a further 110; when these were finished, it would have nearly 900 cars, of which 500 would be top-covered, 250 without top covers, and 117 of the old converted horse-car type. Recently, through the damage done to the cars by the action of snow and salt getting into the motors, no fewer than 120 cars were taken off duty. The engineer had been asked to report on the feasibility of having the motors so encased as to prevent such damage.

Haslingden.—Since the opening of the Haslingden electric tramways in September there has been a heavy loss on the undertaking, roughly estimated at over £1,000 a year. An agreement has now been arrived at, under which the neighbouring borough of Accrington will from February 1st supply energy and cars at a charge of less than 6d. per car-mile, instead of 7d. as before, and it is hoped that this will enable the Corporation to get the undertaking on a better basis, as it will effect a saving of about £12 a week. The arrangement is for three years, and will leave Haslingden for the present free to leave the question, whether it shall erect its own generating station, over for future consideration.

Ilford.—The U.D.C. has received from the B. of T. sanction to a loan of £4,200 for tramway purposes.

Lancashire and Cheshire.—The local municipal tramway managers, at a meeting held recently to consider the B. of T. recommendation as to speed indicators, came to the conclusion that there was no reliable speed indicator on the market.

Liverpool-Southport Railway.—Col. Druitt conducted a B. of T. inquiry at Marsh Lane Station, Liverpool, on Thursday, January 28th, into the accident which occurred on January 21st on the Liverpool-Southport electrical line of the L. & Y. Railway, whereby an electric train collided with another one in the fog, and a fire followed involving the destruction of four coaches and damages to others. The Inspector was assisted by Mr. Trotter, the electrical adviser to the B. of T.; and among those present representing the company were Mr. O. Winder (assistant chief mechanical engineer), and Mr. H. E. O'Brien (resident electrical engineer).

The principal evidence was tendered by employés of the company. Joseph Potter, signalman at Marsh Lane Railway Station, who had been in the L. & Y. Co.'s service for 23 years, was closely examined regarding the trains that collided, and practically admitted that the collision was due to his not adhering to the signalling regulations, and to the dense fog which caused him to mistake the trains.

Thos. Jones, driver of the 7.10 train, said that the electrical current went off immediately the collision occurred, and all the lights went out. The current, however, came on again about half a minute afterwards. He went to the front part of the train in order to cut off the current on both lines. Just then he heard another train coming along on the up line and tried to stop it, but was too late. The new train stopped just opposite to the others, and the current being off it could go neither backward nor forward. Each train carried two extincteurs—one at each end; but water was not playing from them on to the fire when he got back. He had used extincteurs on a fire before, and had succeeded in putting it out; but he had never had occasion to use sand, which they also carried.

Several other witnesses for the company were heard, including electricians from sub-stations on the line, who were examined by Mr. Trotter as to the effect noticed at their respective stations at and after the collision. They stated that the "breakers" came out as in the event of an "overload." Information of the trains being on fire was communicated to them by telephone.

Mr. H. E. O'Brien, resident electrical engineer, stated that the shoe fuses would not have operated in this case. Extincteurs had served to put out a fire caused by electrical current. There were practically no further precautions that could be taken in the shape of using non-inflammable woods in the construction of the carriages. These woods, if used, were not satisfactory, because of their effect in the corrosion of the metals in the carriages. The motor compartments were lined with a non-inflammable substance.

In reply to Mr. Trotter, witness said that in his opinion the fire broke out above the floor level, and before reaching the circuit-breakers.

Evidence as to the company's fire appliances was given, during which it transpired that the attendant at the sub-station did not know where the water valve was. The inquiry then concluded.

London.—Comparative returns of tramway traffic (L.C.C.) during the week ending January 23rd, 1909, and the corresponding week of 1908, show that 81 miles of electric and 38 miles of horse tramways were in use on the former date as compared with 66 miles electric, and 48 miles horse, on the latter. The passengers carried during the respective weeks were 7,617,965 and 6,527,811.

Morecambe.—The award of Major Cardew, arbitrator in the proceedings in which the Morecambe Corporation sought to acquire the Morecambe tramway undertaking under Sec. 43 of the Tramways Act, is that £13,391 be paid by the Corporation to the Tramway Co. for the undertaking, and all lands, buildings and works suitable to and used for the purpose of the undertaking. The Corporation is also to pay the costs of the arbitration. The tramway company estimated the value of the undertaking at £15,952, and the Corporation's estimate was £7,661.

Newcastle-on-Tyne.—Mr. Ernest Hatton, general manager of the Corporation tramways, has placed before the members of the Tramways Committee his estimate of income and expenditure for the year ending March 31st, 1910. This shows an estimated income of £205,500, as against £212,000 for the year 1908-9. The items are: Traffic receipts £200,000, against £206,000 for the current year; lighting £5,000, against £5,200; and sundries £500, against £800; a total decrease of £6,500. The expenditure is put down at £120,500, leaving a gross profit of £85,000. The main items of expenditure are: Traffic expenses £58,500, against £60,000 for the current year; general expenses £20,000, against £17,250; general repairs and maintenance £26,200, against £23,750; power expenses £11,000, the same as for the current year; maintenance and repairs at power station £3,500, against £4,200. The expenditure thus shows an increase of £3,000, and the gross profits a reduction of £9,500. Of the profits, £70,000 are allocated to the payment of interest, redemption, and income-tax. The net surplus is estimated at £11,000, as against £19,000 for the current year. Although the estimated traffic receipts were put down at £206,000 for 1908-9, as a matter of fact they have not been realised, owing to various concessions made in regard to fare stages, &c., and to trade depression and disputes; the receipts are really £8,500 down, compared with 1907-8.

Peterborough.—Sir A. B. W. Kennedy has been appointed as arbitrator by the B. of T., to arrange the price of energy as between the Tramway Co. and the Corporation supply department. It is expected that he will also arrange other matters at issue between the two authorities.

Sandgate.—Mr. Cownie, of the National Electric Construction Co., has written intimating that there is no alternative but to break off negotiations, the Council having decided not to admit the overhead trolley system. The Council has decided to petition against the Folkestone Tramways Bill, 1909.

Southampton.—During last half-year the Corporation tramway receipts showed an increase of £1,400 over the corresponding period of 1907. There was an increase in mileage of 45,000.

TELEGRAPH and TELEPHONE NOTES.

Russia.—Out of an expenditure of 3,648,544 roubles authorised for the construction and repair of telegraph lines and of 1,259,000 roubles for telephone lines in 1909, 200,000 roubles is provided for laying a single-wire line between Yakutsk and Okhotsk and 50,000 roubles for work preparatory to laying telegraph wires along the coast of the Sea of Okhotsk, from Petropavlovsk in Kamtchatka to Nicolaievsk on the Amur, and for the construction of radio-telegraph stations in the aforesaid towns; while 434,000 roubles is allowed for the construction of new telephones between the towns of Tiflis and Baku (100,000 roubles), and Odessa, Nicolaiev and Voznessensk (20,000 roubles), and for the extension and repair of existing lines.—*Board of Trade Journal.*

Telephotography.—It is reported that Prof. Korn has invented an improved process of telephotography, enabling a picture to be transmitted from Berlin to Paris in ten minutes.

China.—As a result of representations made by the Diplomatic Body to the Chinese Foreign Office, the telegraph offices in Pekin and Tien-tsin are now in charge of a foreign superintendent. A reduction of 20 per cent. has been made in the rates for internal telegrams.

London.—Fifteen hundred telephone subscribers in the West End were cut off by a fire in Heddon Street recently, owing to the destruction of a distributing station for overhead wires.

Telegraph Interruptions and Repairs:—

	Interrupted.	Repaired.
Port Arthur-Chifu	March 9, 1904	
Pontianak-Saigon	Sept. 16, 1908	
Medan-Penang	Dec. 22, 1908	
Malta-Zante	Dec. 29, 1908	
Paramaribo-Martinique	Jan. 11, 1909	Jan. 30, 1909
Falmouth-Bilbao	Jan. 19, 1909	
Tourane-Amoy	Jan. 19, 1909	
Zanzibar-Mombasa	Jan. 27, 1909	Jan. 29, 1909

Wireless Telegraphy.—Partly as a result of the good work done by the Marconi system on the occasion of the loss of the *Republic* recently, proposals are being put forward in various quarters at home and abroad to make the installation of wireless telegraphy on board ships carrying passengers a compulsory requirement.

It is reported that arrangements are being made for the rebuilding of the wireless telegraph tower at Machrihanish station, which collapsed in December, 1906, during a gale.

CONTRACTS OPEN and CLOSED.

OPEN.

Acton.—February 16th. Meters and materials for the U.D.C. electricity department for one year. See "Official Notices" to-day.

Australia.—Sydney, N.S.W.—April 28th. Branching metallic multiple magneto switchboard at the William Street telephone exchange. See "Official Notices" December 18th.

May 19th. Office of the Deputy Postmaster - General, Sydney.—Supply and delivery of two multiple magneto switchboards.

Tender forms may be obtained, and preliminary deposits paid, at the Commonwealth Offices in London, 72, Victoria Street, S.W.—*Board of Trade Journal.*

Queensland.—Telephone material for the Postmaster-General's Department. See "Official Notices" January 22nd.

Brisbane.—March 29th. Office of the Deputy Postmaster-General, Brisbane.—Supply and delivery of ironwork, insulators, iron wire, bronze wire and covered wire.

May 31st. Branching multiple magneto switchboard at Toowoomba. Tenders to the Deputy Postmaster-General, Brisbane. Tender forms from, and deposits payable at, the Australian Commonwealth Offices in London, 72, Victoria Street, S.W. Particulars may also be seen at the offices of the Electrical Review.

Melbourne.—February 23rd. 5,000 telephone cases and associated parts, and telephone parts for 5,000 telephone wall sets, for the Postmaster-General's Department, Melbourne. Offers will be considered for any quantity of sets from 1,000 upwards. Preference will be given to Australian material. The conditions and specification may be seen by British firms on application at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

March 23rd.—Office of the Deputy Postmaster-General, Melbourne.—Supply, delivery and erection of power plant for the Central Telephone Exchange, Melbourne.

Belgium.—Antwerp.—February 16th. Two generating sets are required by the Commandant du Génie, Antwerp, for the station at the new military hospital. Particulars from 15, Rue des Augustins, Brussels, for 10d.

Birmingham.—February 8th. Stores for the Tramways Committee. See "Official Notices" January 15th.

Blackburn.—February 16th. Stores for the Electricity and Tramway Committee. See "Official Notices" January 29th.

Cardiff.—February 19th. Two 300-kw. motor-alternators for the Corporation. See "Official Notices" to-day.

Clacton.—February 17th. Overhead travelling crane for the U.D.C. electricity works. See "Official Notices" January 29th.

Germany.—Cologne.—February 20th. A very large order is to be given for battery material by the Prussian State Railways Administration. Particulars are available, against 1s. P.O., at k. Eisenbahndirection, Dornhof, 28.

Ilford.—February 23rd. Meters and other stores for the U.D.C. electricity works. See "Official Notices" to-day.

Italy.—February 26th. The municipal authorities of Francavilla-Fontana are inviting tenders for the establishment of a central station for the public electric lighting of the town.

Leeds.—February 25th. Stores for the Corporation Electrical Department. See "Official Notices" January 29th.

February 20th.—Coals and materials for the Tramways Committee. Mr. J. B. Hamilton, General Manager.

London.—Islington.—February 5th. Electrical and engineers' stores for the Council. See "Official Notices" January 15th.

Bermondsey.—February 15th. Various materials for the Council's electricity and destructor works. See "Official Notices" January 22nd.

Brixton.—February 16th. Electric light and bell installation at the School of Building (Extension), Brixton, S.W., for the L.C.C. See "Official Notices" to-day.

Marylebone.—February 16th. Stores for the Council's electricity department. See "Official Notices" January 22nd.

February 17th. Electric fittings, reflectors, switches, &c., for about 2,000 existing street lanterns for the B.C. See "Official Notices" to-day.

Stepney.—February 17th. Electric light installation at Redman's Road Elementary School for the L.C.C. See "Official Notices" January 29th.

Manchester.—February 10th. Storage battery with reversible booster, switchboard, wiring, &c., for the Waterworks Committee. See "Official Notices" January 29th.

Middlesbrough.—Transporter bridge over the Tees, for the T.C. A. Sockett, Town Clerk.

Newport (Mon.).—February 23rd. Three four-wheeled double-deck tramcars for the Electricity and Tramways Committee. See "Official Notices" to-day.

Norway.—February 12th. Various telegraph material for the Norwegian State Railways. Tenders are to be marked "Anbud paa Telegrafmateriel," and delivered at Styrelsen for Statsbanernes Expeditions-Montor, Christiania. Specifications, &c., may be consulted by British manufacturers on application at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

[It should be noted that in all Norwegian Government contracts a preference of from 10 to 15 per cent. (apart from Customs duties) is given to Norwegian manufacturers, and that it is obligatory that a resident agent (not necessarily a Norwegian firm) should act for tenderers not residing in Norway.]

Portsmouth.—February 15th. Coal, also various stores for the Tramway Committee for one year. See two "Official Notices" January 29th.

Prestwich (Lancs.).—February 8th. Electric light installation at Clough sewage works, for the U.D.C. Lewis A. Orford, Clerk.

Sheffield.—February 15th. Steam and feed piping, valves and connections, water meter, and ironwork for a new boiler at Neepsend electric power station. See "Official Notices" to-day.

South Africa.—Johannesburg.—Messrs. Eckstein and Co. are asking for estimates for 97 motors and equipments, ranging in size from 180 h.p. to 25 h.p. each, to the specifications of Mr. H. T. S. Heather, consulting engineer to the firm. These motors are of the three-phase 50-cycle slip-ring type, 600 r.p.m., and quotations are asked in each case, for pressures of 2,000, 500 and 200 volts; they are required for the equipments of a dozen gold mines, and details are given in *The African World* of January 30th.

Salford.—February 15th. Stores for the Electricity Department. See "Official Notices" to-day.

St. Helens.—February 17th. Condensing plant and other work at Cropper's Hill power station for the Electricity Committee. See "Official Notices" to-day.

Stockport.—The B. of G. have decided to invite tenders for alterations to the electrical installation of Stepping Hill Hospital.

Turkey.—Constantinople.—Tenders are required by the Imperial Post and Telegraph Administration for the supply and delivery of 33,000 kilos. of 2·5 mm. diameter copper wire, 1,160 iron insulators of medium type, 225 small insulator tubes for 2·5 mm. wire, a drum for winding the wire, and a dynamometer for Africa. The British Chamber of Commerce will give further particulars if required. Tenderers must deposit 10 per cent. of contract in cash, or get a bond or guarantee to be signed by the Turkish Consul in London, or the Notary of the Constantinople Chamber of Commerce.

CLOSED.

Accrington.—The T.C. has accepted the tender of Messrs. Ferranti, Ltd., for a switch panel for new motor work at the works of Mr. R. S. Crossley, and the tender of Mr. R. P. Gerland for an overhead line from Lonsdale Street to Mr. J. Crossley's rope works.

Beckenham.—The Council has decided that subject to an adjustment in respect of the price of lamps included, and to all three contractors being willing to accept the price of the lowest for each item, the tenders for 12 months of Messrs. Buchan & Curwen, Mr. H. W. Tyler, and Messrs. Oscar Jones & Co., who are all Beckenham firms, be accepted.

Birmingham.—The Guardians have accepted the tender of Messrs. Richardson & Carlmark, of West Bromwich, for the installation of telephones at the Workhouse.

Bradford.—The two 3,000-KW. turbines which, as already announced, are to be put in by the B.T.-H. Co., will be of the Curtis vertical type.

Blackburn.—Messrs. Howe & Co. are supplying the electrical fittings for the new Theatre Royal at Blackburn.

Brighton.—The Lighting Committee of the T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for three boilers, superheaters, economisers, &c., for the Electricity Works, at £15,370.

Dover.—For the supply of cables for the extension to the Duke of York's School the tender of Messrs. Glover & Co., at £500, has been accepted.

Dudley.—The B.C. Tramway and Lighting Committee has ordered 25 electric meters from the Electrical Co., Ltd., at £48.

Falkirk.—An order for 232 cells and an Entz booster, for working across the outers of the lighting system, has been placed with the Chloride Electrical Storage Co., Ltd.

Fareham.—At the U.D.C. meeting on Tuesday the tenders for the first sections of generating plant for the new electricity works, which have been designed by the consulting engineers, Messrs. May & Hawes, were brought up for consideration. The tenders, of which 39 were submitted for the four sections, were explained in detail by the consulting engineers, and upon the recommendation of the E.L. Committee the Council decided to allot the contracts as under, subject to the final details in each case being arranged to the engineers' satisfaction:—

Sections A and B.—Sulzer Diesel engines and Crompton fly-wheel alternators, The Diesel Engine Co., Ltd., £5,177.
Section C.—High and low pressure switchboards, the Electric and Ordnance Accessories Co., Ltd., £397.
Section D.—Overhead travelling crane, John Smith (Keighley), Ltd., £61.

The specifications for buildings, transformers, cables and flame arc lamps will be issued at an early date.

Germany.—The Benrather Maschinen Gesellschaft, of Benrath, Dusseldorf, have submitted the lowest tender for the supply and erection of 43 electric cranes at the docks at Hamburg, quoting £29,587.

Glasgow.—The Corporation has accepted the following tenders:—

Special track work—Lorain Steel Co.
Lewis bolts, &c.—W. C. Yuille & Co.
Armature pinions—Alfred Wiseman.

Leyton.—The D.C. received the following tenders for the electric light installation at Cobbold Road School:—

W. G. Cannon & Sons, Ltd., (*a*) if with "Simplex" steel conduits, £221 11s., (*b*) if with wood casings in lieu of "Simplex" steel conduits, £209 10s. 6d.
J. T. Halsey, (*a*) £119 16s. 8d., (*b*) £113 19s. 6d.
Headland & Headland, (*a*) £155, (*b*) £120.
Pemberton, Arber & Carey, (*a*) £126 12s., (*b*) £140 14s.
Pinching & Walton (accepted for *a*), (*a*) £109 5s., (*b*) £121 5s.,
Ryan & Sons, (*a*) £124 10s., (*b*) £123.
William Simmons, (*a*) £169 19s., (*b*) £160 10s.
Tilley Bros., (*a*) £144, (*b*) £132 10s.
W. R. Woodward, (*a*) £117 5s., (*b*) £119 10s.

London.—L.C.C.—The following tenders were received for the electric light wiring, &c., of the new fire station erecting in Copenhagen Street, Caledonian Road:—

Lund Bros. & Co. .. (accepted)	£126	Tredegar & Co.	£165
G. E. Taylor & Co.	138	Comyn, Ching & Co.	171
Tilley Bros.	142	W. Leonard & Co.	250
Engineer's estimate	£185		

The Highways Committee received the following tenders for the supply of 155,000 stoneware ducts for further tramway electrification:—

Stanley Bros., Ltd. (accepted) (less 2½ % for cash)	£1,689
Hosea Tugby & Co.	1,688
H. R. Mansfield	1,688
Robinson & Dowler	1,689
Doulton & Co.	1,724
Geo. Skey & Co.	1,727
Sutton & Co.	1,758
Ensor & Co.	1,786
Jas. Oakes & Co.	1,824
Thos. Wragg & Sons, Ltd.	1,882
Donington Sanitary Pipe and Firebrick Co. ..	2,037
Leeds Fireclay Co. (50,000) .. .. (less 2½ %)	850
Ralph Ashworth & Co. (50,000)	900
A. McNair & Co.	2,926
National Fireproofing Co.	2,967

The tenders for laying stoneware cable ducts were as below:—

Reid Bros. .. .. (accepted)	£13,376
Westminster Construction Co.	13,8 6
Dick, Kerr & Co.	13,988
W. Muirhead & Co.	15,204
J. A. Ewart	15,261
Clift Ford	16,023
Jno. Mowlem & Co.	16,352
British Insulated & Helsby Cables, Ltd. ..	16,554
Estimate of chief officer of tramways	12,190

Messrs. Reid are to sublet portions of the work to the Associated Portland Cement Co. (cement) and Messrs. J. Gibb & Co. (ironwork).

The following firms tendered for car traversers for the central car repair depôt and Norwood car-shed:—

Mountain & Gibson, Ltd. .. .. (accepted)	£1,907
Hurst, Nelson & Co.	2,390
Heenan & Froude, Ltd.	2,881
Jos. Booth & Bros.	2,590
Applebys, Ltd.	2,718
Estimate of chief officer	2,450

For screwing machines for the car repair depôt, the following selected firms tendered:—

Selig, Sonnenthal & Co.	£250*
Schuchardt & Schutte .. .. .. (accepted)	254
Buck & Hickman, Ltd.	316
A. Herbert, Ltd. .. .. (alternative tenders)	351 and 370
J. Holroyd & Co.	410
Chief officer's estimate	290

*The acceptance of this tender would involve maintaining a stock of extra dies, costing £15.

The only tender received for oil and waste saving machinery was that of the Oil & Waste Saving Machine Co., Ltd., at £209. (The officer's estimate was £180). The tender has been accepted, as a similar machine is in use at Greenwich electric generating station. Five firms were invited to tender.

The Council has accepted the tender of Messrs Dick, Kerr and Co., Ltd., at £422, for rewinding the 500-KW. motor-generator at Greenwich generating station.

Bermondsey.—The B.C. received the following tenders for an electrically-driven pump capable of delivering 10,000 gals. per hour:—

Dean & Beal, Ltd.	£65
Siemens Bros. Dynamo Works, Ltd.	£65, £66 and £72
W. H. Allen & Co., Ltd.	£65
Brush Electrical Engineering Co., Ltd.	£63 and £67
Gwynnes, Ltd.	(accepted) £60
Mather & Platt, Ltd.	£92
Worthington Pump Co., Ltd.	£76, £186 and £194
Lund Bros.	£61

Messrs. Siemens Bros.' tender was less 2½ per cent., and Messrs. Mather and Platt's £3 extra for impellers and guide tips.

Mountain Ash.—The U.D.C. has accepted the tender of Messrs. Williams Bros., of Ynysbwl, for the erection of an electric light station; that of Messrs. Ferranti, Ltd., for switchgear, &c., £377; and that of the British Insulated and Helsby Cables, Ltd., for overhead wires, at £478.

Wednesbury.—The T.C. has accepted the tender of Messrs. Johnson & Phillips, Ltd., Charlton, S.E., for an underground feeder main, 1¼ miles in length.

CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDEEN.—Alterations and additions at 388, Great Northern Road, for R. M. Falconer, grocer. Alterations of premises, for D. Reid, pawnbroker; George Coutts, architect, 22, John Street, Aberdeen. Additions at 147-151, George Street, for J. Bensie, warehouseman; A. C. Bruce, architect, 124, Union Street, Aberdeen. New fish-curing premises in Raik Road; Cameron & Watt, architects, 381, Union Street, Aberdeen. Alterations for North Line Steam Fishing Co.; Kelly & Nicoll, architects, 367, Union Street, Aberdeen. Additions to works, for J. K. Milne, granite merchant; Duncan Hodge, architect, 20, Bonderond Street, Aberdeen. Dwelling houses in Willowbank Road, for W. Henderson & Son, architects. Addition and alterations to Four-Mile House, Bucksburn; Geo. B. Mitchell, architect, 148, Union Street, Aberdeen. Roller skating rink at Queen's Cross.

ABERDEENSHIRE.—New buildings on Haddo House Estates; C. G. Smith, factor, Haddo House, Aberdeenshire.

ALCESTER.—New secondary school, for Warwickshire C.C. F. P. Trepess, architect, Church Street, Warwick.

ALDERSHOT.—Offices, Farnborough Road, for Ripley, Strong & Co.; house and dairy premises, Rectory Road, for W. Stilwell; stables, Queen's Road, for G. E. Morton; house, Church Avenue, for H. W. Yates. Hippodrome; B. Crewe, architect, 15, Shaftesbury Avenue, W.C.

ALFRETON.—New Primitive Methodist Church.

AMPTHILL (Flitwick).—Proposed parish hall and rifle range.

ASHBOURNE (Derbyshire).—Chapels at proposed new cemetery. Surveyor, Council Offices, Ashbourne.

ASHTON-IN-MAKERFIELD.—New baths for the U.D.C. J. Wilson & Co., builders, Caroline Street, Wigan.

AYR.—Proposed extension of the Glenafton Sanatorium (£4,960). J. H. Turner, Chairman of the Pulmonary Phthisis Board of the Ayrshire Sanatorium.

BALCOMBE (Sussex).—Important drainage scheme, for Cuckfield R.D.C, (£8,000). Strachan & Wilkes, engineers,

BALLINAHINCH (Co. DOWN).—New Independent Church to replace church destroyed in recent storm.

BANGOR.—Sanatorium (£3,000). H. J. Blane, architect, Rutland Square, Edinburgh.

BARMOUTH.—Alterations and additions to Caersalem Calvinistic Methodist Church. O. M. Roberts & Son, architects, Portmadoc.

BARNSLEY.—School extensions, Keir Street; S. Taylor & Son, builders, Barnsley. Semi-detached villas, Gawber Road; W. T. Turner, architect, Market Hill, Barnsley. Alterations and additions to 21 and 23, Shambles Street, for S. Jackson; houses, Rockingham Street, for G. A. Waring; Summer Lane, for Geo. Haigh; Fife Street, for G. Fieldhouse; new school in Grove Street, for the T.C.

BATH.—Extension of the Technical Schools, for the T.C. (£800).

BEDDINGTON (near CROYDON).—Houses, Croydon Road, for Beddington Sand Pit Co.; Highfield Road, for H. E. Rowland; additions to "Lilliesleaf," Woodcote Valley Road, for Mrs. Thacker.

BEDLINGTON (NORTHUMBERLAND).—Enlargement of the Bedlington Council School, and new school at Netherton.

BERWICK-ON-TWEED.—Extensive alterations and additions to business premises, for Paxton & Purves, Ltd.

BIRMINGHAM.—Alterations and extensions to premises, New Street, for Sassons & Co. (including electric passenger lift); extensive alteration of premises, for J. Shepherd, Ltd., coachbuilders, Cheapside. Skating rink; J. Archer, architect, 13, Temple Row, Birmingham. Schools at Rounds Green; A. Long, architect, New Street, West Bromwich.

BLACKPOOL.—Prospective restoration, after fire, of part of the Convent of the Holy Child, Layton Hill, The Mother Superior; new Carnegie library, Borough Surveyor; houses and shops, Whitegate Drive, J. Parkinson & Sons, Ltd., builders, Kent Road; shops, Pleasant Street, for Jas. Bibby; new church, Newton Drive, for the Trustees of the United Methodist Church.

BLAENAVON (near PONTYPOOL).—Important developments at Blaenavon Ironworks.

BLAIRGOWRIE.—School. D. and J. R. McMillan, architects, 105, Crown Street, Aberdeen.

BOLTON.—Three new libraries; Borough Surveyor. Extensive additions to the Convalescent Home, Whitehill, Sharples; Bradshaw and Gass, architects, 19, Silverwell Street, Bolton. Ten houses in Bristol Avenue, Tonge, Leigh Bros., Ltd.; screen sheds at Darcy Lever Sewage Works, Borough Engineer; forty-two houses in Hastings Road, G. Duxbury.

BOOTLE (near LIVERPOOL).—Workmen's dwellings, &c., for the T.C. (£7,100).

BOURNEMOUTH.—Extension of business premises, 82, Commercial Road, for the London and Provincial Furnishing Co.

BRADFORD.—Store in Westfield Road, Manningham, for the City of Bradford Co-operative Society, Ltd.; W. Rycroft, architect, Bank Buildings, Manchester Road, Bradford. Enlargement of St. William's Schools, Bingley Street, Brownroyd; E. Simpson and Son, architects, 12, Cunliffe Terrace, Manningham, Bradford.

BRENTFORD.—Office, Canal Wharf, Brentford End. Thomas & Thomas, architects, 191, Edgware Road, W.

BRIDLINGTON.—New Primitive Methodist Sunday Schools, Chapel Street; J. Earnshaw, architect, Carlton House, Willington Road, Bridlington. Lavatories, for the T.C.; borough surveyor. Enlargement of High School for Girls (£6,650); John Bilson, architect, 23, Parliament Street, Hull. Extensions to printing office, Manor Street, for Wm. Forster. Alterations to premises and new shop, Chapel Street, for W. H. Jones.

BRISTOL.—Alterations and extensions to business premises, Clifton, for J. Cordeux & Sons, Ltd., drapers.

BROMSGROVE.—Additions to Aston Fields Workmen's Club.

BUCKHAVEN.—New fire engine house. Mr. Telfer, burgh surveyor, Buckhaven, Fife.

BUDE (CORNWALL).—Sunday schools and house. E. Wise, architect, Launceston.

BURNLEY.—Proposed new Church of St. Mark's, Rose Grove. Rev. T. H. Taylor, Vicar.

BURSLEM.—Proposed new Church Mission Hall, Scotia Road. Rev. H. Redgrave, Vicar of St. Paul's, Burslem.

BURY.—Alterations at local Athenæum. F. Booth, hon secretary.

CARDIFF.—Extension of Hancock's Brewery and new offices in Crawshay Street; Hy. Budgen, architect, 95, St. Mary Street, Cardiff. Show-rooms in Frederick Street, for Perry & Turner; E. H. Cousins, architect, Cardiff. Art block at Canton Secondary School; James & Morgan, architects, Charles Street Chambers, Cardiff. Roller Skating Rink in Cardiff Arms Park; C. F. Ward, architect, Birmingham. Congregational Chapel at Roath Park; Habershon & Fawckner, architects, High Street. Cardiff Additions and extensive alterations at 5, High Street, for D. T. Alexander; E. W. M. Corbett, architect, Bude Estate Office, Castle Street, Cardiff. Motor garage in Richmond Road; E. R. Evans & Co., builders and architects. Mission room in Milton Street; Spier & Bevan, architects, Wharton Street, Cardiff.

CARSHALTON.—Five houses, Stanley Road. A. B. Cook, builder, Cranley House, Wallington.

CHAPEL-EN-LE-FRITH.—Important water supply scheme at Hope, for the R.D.C. (£4,280); Swann & Brady, engineers. Sewage works developments; Surveyor, Council Offices, Chapel-en-le-Frith.

CHARD.—Hospital laundry at workhouse; F. G Ross, clerk to Guardians.

CHATHAM.—School, Luton Road, for the T.C.; H. H. Dunstall, architect, 2, The Paddock, Chatham.

CHELMSFORD.—Houses, Bradford Street, for G. Grimwood & Sons; Rainsford Road, for Walter Cowell; Rosebery Road, for Jesse Gowers; Grove Road, for H. Love & Sons.

CHELTENHAM.—Renovation and enlargement of St. Peter's Parochial Schools.

CHESTER.—Music Hall for Milton, Bode & Co.; Lockwood & Son, architects, 80, Foregate Street, Chester.

CHIPPENHAM.—Villas, Audley Road. W. J. Rogers, builder, Okus Road, Swindon.

CHIPPERFIELD.—New Church Institute. Trustees of Baptist Church.

CHIPPING NORTON.—Additions to house and stabling at "Foxholes" (£4,500). Cancellor & Hill, architects, 12, Jewry Street, Winchester; A. Groves & Sons, builders, Milton, Oxfordshire.

CLEVEDON.—Renovation of the Wesleyan Methodist Church (£350).

CLYDEBANK.—New Congregational Church at Radnor Park.

COVENTRY.—Wesleyan Methodist Church and schools in the Quadrant, Warwick Road. Extensions to works, Cheylesmore, for the Swift Motor and Cycle Co. School, Windmill Lane; J. Willmott, county surveyor, Warwick; A. Lord, builder, Wolston, Coventry. Factory sheds; F. Tickney, architect, High Street, Coventry.

COWDENBEATH (N.B.).—Miners' Institute. Mr. Campbell, architect, Stenhouse Street, Cowdenbeath.

COWLEY (OXFORD).—Police station. City surveyor, Oxford.

CRIEFF (PERTHSHIRE).—Alterations for Strathearn Steam Laundry Co.

CREWE.—Proposed Institute for St. Peter's Parish; Rev. A. H. Waller, rector. New Police Station for Cheshire C.C. (£2,000); county architect, Chester. Proposed ice factory for a new local concern.

CROWTHORNE (near READING).—Hall for Mr. Sworder, Crowthorne.

CROYDON.—Enlargement of the Sanitary Steam Laundry, Strathmore Road; W. Payne, Birmingham. Mission hall, Dennett Road; J. Williams, Purley. Six houses, Strathyre Avenue, Norbury; W. J. Allen & Son, Streatham, S.W.

DARFIELD (YORKS.).—Important sewage works for the U.D.C. (£5,925). Balfour & Son, engineers, Newcastle-on-Tyne.

DARLINGTON.—School (£10,000); G. Winter, borough engineer, Town Hall, Darlington. Girls' high school (£12,380). New subway (£4,000); G. Winter, borough surveyor.

DODWORTH (YORKS.).—Alterations and additions to the Miners' Inn. R. and W. Dixon, architects, 5, Eastgate, Barnsley.

DONCASTER.—Sunday Schools at Woodlands (£1,650); H. Beck, architect, Dolphin Chambers, Doncaster; Mullins & Richardson, builders, Doncaster. Race stand and enclosure, for the T.C. (£5,960); Mullins & Richardson, builders.

DOVER.—Nine houses at Chapel Hill, Eythorne, for Mr. Terry, 59, London Road, Dover. J. S. Ovenden, builder, Alfred Road, Dover.

DUDLEY.—School; T. Glazebrook, architect, 23, Wolverhampton Street, Dudley. Extensions at the Workhouse; Nichol & Nichol, architects, 117, Colmore Row, Birmingham.

DUNFERMLINE.—High school extensions (£6,000). D. Barclay, architect, 245, St. Vincent Street, Glasgow.

DUNSTABLE.—New Wesleyan Church. Withers & Meredith, architects, Cannon Street, London, E.C.

DURHAM COUNTY.—Secondary schools at Blaydon (£9,350); Ryhope (£12,350); and Chester-le-Street (£13,000); extensions to schools at Hartlepool (Henry Smith school) (£11,000), and Wolsingham Grammar School (£18,000).

EASTBOURNE.—Shops and flats, Upperton Road; C. L. Morgan, architect, care of L.B. & S.C. Railway Co. Six houses, St. Anthony's Hill; shop, 145, Seaside; workshop and store, 43, Terminus Road; Mitchell & Ford, architects, 7, Gildredge Road, Eastbourne. Two pairs of houses, Prentice Road; C. Crisford, architect, 49, Gildredge Road. Six houses, Sidley Road, and detached house, Kitchenham Road; A. A. Oakden, architect, 10, Cornfield Road.

EAST COWES (I.W.).—Five houses, Grange Road. E. Sibbick, builder, Grange Villa, Adelaide Road.

EASTLEIGH (HANTS).—Sixty-four houses in Chamberlayne Road, Eastleigh, Weston & Burnett, architects, Southampton.

EAST RIDING (YORKS.).—Proposed new schools at Barlby, Stamford Bridge, Sutton, Downe, Withernsea and Foggathorpe; also school extensions at Norton, Rye Hill, Thwing, and Walkington; Bernard B. Stamford, Building Surveyor, County Hall, Beverley.

EAST STONEHOUSE (DEVON).—Alterations to premises, St. Mary Street and Clarence Place, and to the Workhouse. Thornely & Rooke, architects, 11, The Crescent, Plymouth.

ECCLES.—Elementary school in Beech Street, Winton. H. Lord, architect, 42, Deansgate, Manchester.

EDINBURGH.—Three new schools for supplementary classes (proposed). Clerk, School Board, Edinburgh.

ELLAND.—Important extensions to the works of J. Lumb & Son. Marshall and Rushworth, builders.

EPSOM.—Additions to Manor Asylum (£10,627); J. S. Carmichael, builder, Wandsworth. New workshops at Epsom College, for the Governors.

ERDINGTON.—School. J. Willmott, county surveyor, Warwick.

FARNBOROUGH (HANTS).—New schools for the C.C. (£9,365).

FARRINGDON.—New Primitive Methodist Church at East Peach.

FENTON.—Reconstruction of premises (after fire), for E. Hughes & Co., china manufacturers. Grog-grinding plant, King Street; Potteries Electric Traction Co., Stoke-on-Trent. Disinfector station, steam-roller house, fire-engine house, and residence; the Surveyor, Fenton Urban Council. Council school (£4,000); R. T. Adderley, clerk to the Fenton U.D.C.

FERRYHILL.—Church. Davidson & Sons, architects, Newcastle-on-Tyne; Stafford & Sons, builders, Sunderland.

FISHPONDS (GLOS.).—Extension of All Saints' Church (£2,260). Lingen-Barker, Son & Ellis, architects, 3, Unity Street, Bristol; E. Clark & Sons, builders, Fishponds.

FLEETWOOD.—New Hippodrome; A. Winstanley, architect, Manchester, and St. Annes-on-Sea. Eighteen houses, Nansen Road and Clifton Road, S. Crosby; oil stores, surveyor, Council Offices, Fleetwood.

FOCHRIW.—New school. W. E. R. Allen, Cardiff.

FREEMANTLE.—Police Station. J. Crowther, Southampton.

GARSTON (LIVERPOOL).—Schools. E. Ware, architect, Exchange Street East, Liverpool.

GATESHEAD.—Primitive Methodist Church and Schools, in Dryden Road (£6,000).

GLASGOW.—Storage accommodation at Alexandra Parade; A. B. M'Donald, surveyor, Glasgow Corporation. Alterations and additions to Nos. 121 and 123, Argyle Street, for the Glasgow and South-Western Railway; the engineer, St. Enoch Station, Glasgow. School at Hyde Park; Dykes & Dale, architects, 65, West Regent Street, Glasgow; Meiklejohn & Sons, builders, Glasgow.

(YOKER).—Extension of infant school. The Clerk, Renfrew Landward School Board.

GOSPORT.—New asylum block at the Royal Naval Hospital, Haslar.

GRANTHAM.—Secondary school for girls. Mr. Dunne, architect, Lincoln.

GRANGEMOUTH.—Double villas and flats in Wallace Street, for J. M. Robertson, architect, 85, Boness Road.

GRAVESEND.—Extensive alterations to business premises, 29 and 30, Parrock Street, for Darby & Son, drapers.

HADLEIGH.—School (700 places) for Essex C.C.

HALIFAX.—New church. Sutcliffe & Sutcliffe, architects, Hebden Bridge.

HANLEY.—Additions to works, Slippery Lane. C. Cornes.

HARROW.—Twelve houses, Sussex Road. A. E. Crook & Co., architects, Lowlands Road, Harrow.

HASTINGS.—Additions to convalescent home for poor children, West Hill, St. Leonards; Pigott & Oxley, architects, Saxon Chambers, London Road, St. Leonards. Mineral water manufactory, Caves Road, St. Leonards, for J. Martin & Co.; R. Hembrow, architect, 174, Queen's Road, Hastings. Alterations and additions to business premises, 28 and 29, Robertson Street, Hastings; A. Maconie, owner; H. Ward, architect, Bank Buildings, Hastings. Alterations to business premises, 37 and 39, Norman Road, St. Leonards; F. Povey & Co., owners; P. Tree, architect, London Road, St. Leonards.

HAWICK (N.B.).—Proposed Dominican Convent.

HECKMONDWIKE.—Additions to the Working Men's Club.

HERSHAM (SURREY).—New Congregational Church (£3,000); also proposed Sunday School, &c. (£1,500). Rev. Herbert G. Crouch, minister.

HIGHBRIDGE.—Public slaughter-house. Clerk, Urban District Council.

HOLYHEAD.—Baptist Chapel and schoolroom; W. B. Rees, architect, 3, Dumfries Place, Cardiff. Important works for the Waterworks Co. at Llyn Traffwyi; H. Rofe & Son, engineers, 8, Victoria Street, Westminster.

HORWICH (LANCS.).—School (£12,000); H. Littler, architect, 16, Ribblesdale Place, Preston. Proposed extensions at Victoria Mills.

HOUGHTON-LE-SPRING (Co. DURHAM).—Proposed new theatre in Newbottle Street, for a private company.

HOUNSLOW.—Iron factory building, Inverness Road, for Mouldite, Ltd.

HULL.—Proposed new school for fishermen, Hull Education Committee; Primitive Methodist infant school and institute, Fountain Road (£750); new works at Stoneferry, for the Digit Disinfectant and Soap Co., Ltd., Meltham, Huddersfield.

HYTHE.—Four shops, High Street, Lewis & Co.

ILFORD.—Six houses, Auckland Road, for H. Hollins; six houses, Quebec Road, for J. P. Leggett; ten houses, Wards Road, for Mr. Clark.

INVERURIE (N.B.).—Post Office (£2,200). G. B. Mitchell, architect, 148, Union Street, Aberdeen.

IVER (BUCKS.).—Alterations at Old Parsonage Farm and new farmhouse, for Sir Robert Harvey, Bart.

KENDAL.—Business premises, Finkle Street, for Blacow Bros. S. Shaw, architect, 45, Highgate, Kendal.

KESWICK.—Extension of the Wesleyan Church (£2,056).

KETTERING.—New Congregational Sunday Schools (£3,000).

KIDSGROVE (STAFFS.).—New Church schools and parish room. A. R. Wood and Son, architects.

KINGSTON-ON-THAMES.—Proposed new laboratory; additional office accommodation, for T.C. R. H. Clucas, Borough Surveyor, Kingston.

KIRKHAM.—Proposed alterations at Post Office. Sub-Postmaster.

LANCASHIRE.—Schools at Flixton (£5,058); Aspull New Springs (£3,920); and Adlington (£4,766); Church (£9,885). Dr. H. L. Snape, Lancaster Education Committee, Preston.

LANCASTER.—Conversion of premises, Haverbreaks Estate, into detached residence, for W. H. Hatch.

LANGLEY PARK (DURHAM).—County school. W. Rushworth, Shire Hall, Durham.

LEEDS.—Two houses and alterations to premises, Hyde Park Road. F. Mitchell, architect, 9, Upper Fountaine Street, Albion Street, Leeds.

LEICESTER.—Skating rink, junction of Aylestone and Welford Roads, for Rinking, Ltd., Empress Hall, Earl's Court, London Extensions to Newark Street Schools (£2,288); J. C. Kellett & Son, builders, Southgate Street, Leicester.

LEIGH (LANCS.).—Additions to workhouse; J. C. Prestwich, architect, Bradshawgate, Leigh. Six houses, Manchester Road, Astley; Stockton and Mather.

LEIGH-ON-SEA (ESSEX).—New Congregational Church, Pall Mall.

LEITH.—Three tenement houses in Iona Street. Messrs. G. & R. Cousin, contractors, Waverley Market, Edinburgh.

LETCHWORTH.—Proposed new Post Office.

LEVEN (FIFE).—New Drill Hall (£2,000); Major W. T. Marshall, V.C., secretary of Fife Territorial Association, Cupar. Workmen's Home (£2,000); G. Campbell, architect, East Wemyss, Fifeshire.

LEVENSHULME (near MANCHESTER).—Eleven houses and shop, Brook Avenue, for J. Holt; houses, Thorncliffe Grove, for J. Fox; Essex Street, for Mrs. Fanny Ratcliffe.

LIMERICK.—New theatre. Geo. V. Fogerty, proprietor of the Theatre Royal, Limerick.

LISCARD (CHESHIRE).—New Masonic Hall. J. W. B. Harding, architect, 16, Cook Street, Liverpool.

LITTLEBOROUGH (near ROCHDALE).—Extensions to the Conservative Club (about £900). Blatchinworth & Calderbrook Conservative Building Co.

LIVERPOOL.—Proposed extension of the Police Buildings, Dale Street. Borough Surveyor.

LLWYNYPIA (GLAM.).—Extension and alteration of Dewi Sant Church. J. W. Rodger, architect, High Street, Cardiff.

LONDON (HIGHBURY, N.).—Renovation of Park Church. C. T. Price, chairman of managers, Park Church, Grosvenor Road, Highbury, N.

(LEYTON, N.E.).—New Council schools in Canterbury Road. W. Jacques, architect, 2, Fen Court, Fenchurch Street, E.C.

(SILVERTOWN, E.).—Prospective restoration of soap works, after fire, for J. Knight & Co.

(LEWISHAM, S.E.).—Two houses, Manor Park; W. J. Scudamore and Sons, builders, 13, Manor Lane, Lewisham, S.E. Twelve houses, Eliot Hill; J. Watt, builder, The Lodge, Bromley Road, S.E. Two houses, Myrtle Grove; B. Hosegood & Sons, estate agents, 28, Basinghall Street, E.C. Seven houses, Phœbeth Street; J. Watt, builder, The Lodge, Bromley Road, S.E. Two houses, Farley Road; J. Laird, builder, 13, Berlin Road, Catford, S.E. Addition to Torridon Road school; Griggs and Sons, builder, 71, Manchester Road, E.

(MILL HILL, N.W.).—Alterations to "The Grove." H. Phillips, builder, Mill Hill, N.W.

(HAMPSTEAD, N.W.).—Four houses, Garden suburb; Garden Suburb Development Co., 32 and 34, Theobald's Road, W.C. Building on site of 22-23, New End, for Miss H. S. Creed.

(GOLDER'S GREEN, N.).—Thirty-two houses, Golder's Gardens. E. Streather, builder, Golder's Green, Hendon.

(HENDON, N.W.).—Six houses, Corringham Road; Howard and Lavarack, architects, 41, Bedford Row, W.C. Car repair sheds, Metropolitan Electric Tramways; the Secretary, 101, Finsbury Pavement, E.C. Two new roads, Gladwins Road and Fitzhenry Road; J. Baker, Cooke & Standen, surveyors, 11, Southampton Row, W.C.

(KILBURN, N.W.).—Alterations and additions to Grammar School (£5,644). W. Lawrence & Son, builders, Mosille Works, Tottenham, N.

(LEYTON).—Additions to workshops, Skeltons Lane; W. Shurmur and Sons, builders, Riverside Works, Upper Clapton. Four shops, Lea Bridge Road; H. H. Dartnall, builder, Forest House, Wanstead. Class-room, Emanuel Mission Church, Hitcham Road; T. Brevetor, builder, Turner Square, Hoxton.

(WANDSWORTH, S.W.).—Training college (264 places), two hostels, and secondary school (456 places) at Furzedown; T. J. Bailey, architect, L.C.C. Education Committee, Victoria Embankment. School, Hitherfield Road (£10,117); Galbraith Bros, Ltd., builders, 46, Camberwell Green, S.E. Addition to building at 285-289, Balham High Road; Price, Arrow & Taylor. Proposed additions at Primrose Laundry, Bendon Valley.

(ISLINGTON, N.).—School, Barnsbury Park (500 places). T. J. Bailey, architect, L.C.C. Education Committee, Victoria Embankment.

(PADDINGTON, W.).—Additions to schools, Amberley Road and Essendine Road (600 and 500 places respectively). T. J. Bailey, architect, L.C.C. Education Committee, Victoria Embankment.

(WALWORTH, S.E.).—Buildings on site of 98-104, South Street; T. W. Sloman.

(KENSINGTON, W.).—Building in Walmer Road, Notting Hill, for the Kensington B.C.

LONDON (EAST HAM, E.).—Forty-two houses, Marlow Road; G. Mitchell. Twenty-seven houses, Marlow Road; J. Young. Additions and alterations to bank, 202, High Street North; J. Liscombe, general manager, London and South-Western Banking Co., Ltd., head office, 170, Fenchurch Street, E.C. Twenty-seven houses, Keppel and Norfolk Roads; C. Manning, builder, Temple Works, St. John's Wood, East Ham, E. Sixteen houses, Kempton Road; G. Saxton, builder, Lawrence Road, Plaistow, E. Completion of St. Barnabas Church, Browning Road; Vigor and Co., contractors, 15, King Street, Poplar, E.

(RATCLIFF, E.).—Building at corner of Butcher Row and Medland Street; A. Miller, engineer, 70, Broad Street, Ratcliff, E.

(ST. PANCRAS, N.W.).—Additions to Haverstock Hill school; school, Camden Street (440 places); school, Torrano Avenue (600 places); T. J. Bailey, architect, L.C.C. Education Committee, Victoria Embankment.

(SOUTH KENSINGTON, S.W.).—Additional storey to block of flats in Brompton Road and New Street. W. G. Hunt, architect, 17a, Vicarage Gate, Kensington, W.

(BROMLEY, E.).—Fire station in Brunswick Road.

(LAMBETH, S.E.).—Building in Aquinas and Coin Streets. C. Barker.

(W.).—Building on site of 174, 175 and 176, Piccadilly, and 52 and 53, Jermyn Street. G. T. Jell, architect, 70, Carlton House, Regent Street, W.

(SOUTHWARK, S.E.).—Re-erection of 17 and 19, Crosby Row. J. J. Freeland, architect, 19a, High Street, Clapham, S.W.

(PALMER'S GREEN, N.).—New Congregational school-church in Fox Lane (£1,200).

(PLUMSTEAD, S.E.).—New schools, Griffin Road. Thomas & Edge, builders, Anglesea Road, Woolwich.

(HACKNEY, N.E.).—Rebuilding warehouse, 32, Hackney Grove, and alterations to premises at 307, Mare Street. C. Castle & Son.

(HOLLOWAY, N.).—Alterations and improvements at Junction Road Congregational Church. Rev. F. Burnett, pastor.

(WALTHAMSTOW, N.E.).—Thirty-two houses, Clifford Road; W. E. Hazell, architect, 5, Tavistock Square, W.C. Four houses, Pentire Road; H. Brodley, architect, 259, High Street, Walthamstow.

(SOUTHGATE, N.).—County school (£13,493). Mattock Bros., builders, Winkfield Road, Wood Green, N.

(GREENWICH, S.E.).—Additions to the North Pole Ice Works, Blackwall Lane. F. J. Gorham, builders, Point Hill, Greenwich, S.E.

(S.W.).—Extensive alterations to premises, 22, Regent Street, for Elkington & Co., Ltd., silversmiths.

(HAMMERSMITH, W.).—Flats, Brook Green. F. Hingston, architect, 78, Basinghall Street, E.C.

(MERTON, S.W.).—Pumping station, &c., for the U.D.C. (£6,000).

(HOMERTON, N.E.).—Additions to workhouse infirmary, High Street (£974). F. & G. Foster, builders, Norwood Junction, S.E.

(BARKING, E.).—New police station for Essex C.C. (£7,000 to £8,000).

MAIDENHEAD.—Alterations to offices in High Street, for the Maidenhead Gas Co. Additions, &c., to "Longford," Bath Road; E. W. Almond, 50, Bath Road, Maidenhead.

MANCHESTER.—Proposed free library at Crumpsall (£8,000); Free Libraries Committee, Manchester City Council. New shops and offices in St. Peter's Square; R. Carlyle, contractor, Manchester. Goods office at the Ancoats Goods Depot, for the Midland Railway; Engineer, Midland Railway, Derby.

MANSFIELD.—New Primitive Methodist Schools.

MARGATE.—Alterations and additions to the Deaf and Dumb Asylum. F. Windsor, architect. Additions to Ottery House, Surrey Road, for J. S. Arnold.

MATLOCK.—Buildings at Starkholmes; proposed additions to Matlock Church Schools; Mr. W. Fox.

MELTON MOWBRAY.—Offices, stables, &c., at the cattle market, for the U.D.C. E. Jeeves, surveyor, Nottingham Street, Melton Mowbray.

MERSTHAM (SURREY).—New Wesleyan Church (£1,600). T. R. Hooper, architect, 9, Station Approach, Redhill.

MERTHYR TYDFIL.—Garden city scheme for villa residences, the Goitre J. T. Vaughan.

MERTON (SURREY).—New Church of St. John the Divine (site given by Admiral Smith).

MEXBOROUGH (near ROTHERHAM).—Rebuilding premises for the Barnsley British Co-operative Society. H. L. Paterson, architect, St. James' Street, Sheffield.

MIDDLESBROUGH.—Additions to premises for the Co-operative Society. W. G. Roberts, architect, 61, Albert Road, Middlesbrough.

MIDDLETON (Co. ARMAGH).—New manse for Drumhillery Presbyterian Church.

(LANCS.).—Proposed garden suburb, Alkrington Estate. Thos. Adams, late secretary and manager of Letchworth Garden City.

MILNSBRIDGE (YORKS.).—Twelve houses. Lunn & Kaye, architects, Milnsbridge.

MITCHAM.—Premises at 2, Lilian Road, for E. G. Luckhurst and J. Derville; school, London Road, Morden, for Surrey C.C. offices, Streatham Lane, for Messrs. Pascall.

MORLEY.—Alterations and additions to Peel Street Mills. T. A. Buttery, architect, Queen Street, Morley.

MORPETH.—New school at Hirst, for the Northumberland C.C.

MORTIMER (near READING).—New St. John's Hall. Mosdell, Son & Lovell, builders, Mortimer.

MOTHERWELL (N.B.).—New Primitive Methodist Church, school and manse.

NANTWICH.—Gas works extension. Surveyor, Nantwich Council.

NAVAN.—Proposed Carnegie Free Library.

NENAGH (Co. TIPPERARY).—New national school at the Convent of Mercy (520 children). Moynan & Gill, architects, Court House, Nenagh.

NEWARK.—High school for girls. Brewill & Baily, architects, Parliament Street, Nottingham.

NEWBURY (BERKS.).—New county girls' school (£9,750).

NEW MILLS (DERBYSHIRE).—Public library for the U.D.C. R. B. Preston, architect, Disley and Manchester.

NEWPORT (SALOP).—Proposed new girls' school for the C.C. and the Governors of the Grammar School (£5,000).

NEWPORT (MON.).—New Y.M.C.A. premises (£7,500). W. R. Russell, hon. secretary.

NEW SARUM.—Workshop, stores, &c., Friary Lane (£700). W. J. Goodwin, city surveyor, Municipal Offices, Salisbury; Billett & Musselwhite, builders, Salisbury.

NEWTOWN (LANCS.).—School, Scot Lane. J. W. Horne, secretary, Wigan Education Committee.

NEW TREDEGAR (MON.).—Council offices. Council Surveyor, New Tredegar, Mon.

NORTHAMPTON.—Boot factory at Cogenhoe. Brown & Mayor, architects, Northampton.

NORWICH.—Proposed dental hospital.

OLDBURY.—School. F. J. Gill, architect, Lloyd's Bank Chambers, Smethwick.

OLDHAM.—Important extensions to Greengate Street Schools, for the T.C. (£3,014). Housing scheme contemplated (£10,000); Oldham Equitable Co-operative Society.

ORPINGTON (Kent).—New Free Church.

ORSETT (Essex).—Extensive additions to the workhouse, for the B. of G.; C. M. Shiner, architect.

OSWESTRY.—English Baptist Sunday school; W. J. Oliver, architect, 1, Darlington Street, Wolverhampton. Proposed new secondary school for boys, for Salop C.C. (£6,000).

OXFORD.—School; City Surveyor, Oxford. Wing at Oriel College; Basil Champneys, architect, 19, Buckingham Street, Strand, W.C.

PEEL (Isle of Man).—Proposed Isolation Hospital, for the Peel Branch of the H. B. Noble Nursing Association.

PEMBROKE.—New police station at East Back.

PENDLEBURY.—New school in Cromwell Road, for the Swinton and Pendlebury Education Committee (£10,000). T. J. Bushell, architect, Manchester.

PENCLAWDD.—New Independent Chapel (£3,000). J. Rees, Penlan, Penclawdd.

PLYMSTOCK.—School. P. Morris, Richmond Road, Exeter.

PONTARDAWE.—New school at Trebanos. W. E. R. Allen, deputy clerk to County Council, Cardiff.

PONTEFRACT.—Suggested new schools for the T.C.

PORTSMOUTH.—Workroom for Mme. Ribll, milliner, 10, Elm Grove; G. J. Davis, 7, Cottage Grove, Portsmouth. Additions to 10, Andover Road; W. Ward, builder, Coburg Street, Portsmouth. New Church for St. Mark's Parish (£25,000). Married soldiers' quarters at Clarence Barracks; Director of Barrack Construction, 80, Pall Mall, S.W.

PORT TALBOT.—Twenty-four houses at Bryn; J. I. Thomas, architect, Aberavon. Important colliery developments; D. Davies & Sons, Ltd., Ferndale.

PRESTON.—Extension (£20,000) of County Offices. H. E. Clare, clerk, County Council.

RAMSEY (Isle of Man).—Roman Catholic Church. S. Sherwin & Sons, builders, Bargate Green, Boston, Lincs.

RATTRAY (Perthshire).—Proposed new United Free Church. Rev. Thos. Tully, Rattray.

RAWMARSH (Yorks.).—Shop, High Street, for T. Ward; four houses and shops, Kilnhurst Road, for A. J. Pugh.

RAYLEIGH (Essex).—Probable re-erection (after fire) of residence, Eastwood Road, for C. Slade.

READING.—New bakery for Co-operative Society (£12,699); Mr. Worster, architect to Industrial Co-operative Society; Collier and Catler, builders, St. Mary's Butts, Reading. Proposed church on Caversham Heights; Rev. C. W. E. Cleaver, The Vicarage, Church Road, Caversham. Shop premises adjoining Caversham Police Station; C. Phillips & Son, 22, Upper Redlands Road, Reading, builders. Adaptation of premises in the Forbury for offices for the Berks. County Council.

RETFORD.—Additions to works, Hallcroft Road, for Clark & Co., Ltd.

RICKMANSWORTH.—Catholic Church. Brightman & Son, builders, Watford.

RINGWOOD.—Business premises, Southampton Street, for F. Solfe.

ROMFORD.—County High School for Girls (£8,400); J. B. Hickton and H. E. Farmer, architects, County Chambers, Birmingham.

RUSHDEN.—Additions to factory, for W. Sargent & Co.

ST. ALBANS.—New Church of St. Paul's. J. E. K. & J. P. Cutts, architects, 14, Southampton Street, Strand, London, W.C.

ST. AUSTELL (Bugle).—Extensions and alterations at the Methodist Church. F. C. Jury & Son, architects, Tregonissey Road, St. Austell.

ST. BEES (Cumberland).—Additions to Grammar School and house. A. Huddart, architect, 9, Lowther Street, Whitehaven.

ST. HELENS.—St. Anne's Retreat, Sutton, for Rev. Father Wilkes; dairy, &c., Rodney Street, for J. Turner.

SALE.—County high school for girls (£7,436).

SALFORD.—Underground conveniences, Chapel Street and Oldfield Road (£450); J. Corbett, surveyor, Salford Town Council. Alterations to Star Inn, Ryall Street; additions to bonding warehouse, Clowes Street; alterations to Engineers' Arms, Greengate.

SHELF (near Halifax).—Houses, Belle Vue. H. F. Sharp, architect, Cambridge Buildings, Queensbury.

SHOEBURYNESS.—Probable re-erection, after fire, of residence. Frank Stallibrass, solicitor, Clarence Street, Southend, lessee.

SOUTH MOLTON.—Additions to school. A. Lauder, architect, Bridge Buildings, Barnstaple.

STOKE-ON-TRENT.—Extension of premises, Woodhouse Street; Sall and Robinson. Extensive alterations to premises, Liverpool Road, for Jackson's Stores, Ltd., house furnishers. Alterations at St. Paul's Sunday School, Victoria Street, Stoke-on-Trent; the Vicar.

STRANRAER.—Widening and repairing the West Pier, for the T.C. Crouch and Hogg, engineers, 14, Blythwood Square, Glasgow.

SUTTON-IN-ASHFIELD.—St. Michael's new Church (£4,100). J. Thompson and Co., builders, 48, Wood Street, Peterborough.

SWANSEA.—Offices, Fisher Street; Swansea Offices Co. Twelve residences, Trewyddfa Terrace, Landone; W. Williams, builder, Landone. Rebuilding the Sketty Wesleyan School. Mission hall; G. S. Knight, Cwmbwrla. Twenty residences in Spencer Street and 11 in Eaton Road; D. Cooper, Brynhyfrid, Swansea.

SWINDON.—Drying shed at the Victoria Hospital. Bishop & Fisher, architects, Regent Circus, Swindon.

TAUNTON.—Important additions to the library, for the T.C. (£1,500).

(Bicknoller).—Residence for the Rev. C. Martin at Chilcombe. F. W. Roberts, architect, 2, Hammet Street, Taunton.

TEIGNMOUTH.—School. P. Morris, Richmond Road, Exeter.

THAME (Oxon.).—Proposed enlargements to Thame Undenominational School, for the managers.

THETFORD.—Important sewerage scheme for the T.C. (£22,143). E. Bailey-Denton, engineer, 9, Bridge Street, Westminster.

THUNDERSLEY (Essex).—Enlargement of Voluntary School. Rev. T. N. Major, Rector.

TREORCHY (near Pontypridd).—Three villas, Pencilli Estate. W. D. Morgan, architect, 194, Ystrad Road, Pentre.

TUNBRIDGE WELLS.—New county school (£10,000).

TYLDESLEY (South Lancs.).—Improved sewerage scheme (£2,000 or £3,000). Surveyor, Council Offices, Tyldesley.

ULVERSTON.—Police station at Bardsea, for Lancs. C.C. Henry Littler, architect, 16, Ribblesdale Place, Preston.

UXBRIDGE.—Recreation room adjoining St. Peter's Mission, The Greenway. The Trustees.

WALES (near Sheffield).—Re-building Lord Conyer's Arms Hotel, for the Worksop and Retford Brewery Co., Ltd. Jas. E. Knight, architect, 33, College Street, Rotherham.

WALLASEY.—Six villas, Seaview Road. Horrocks Bros., builders, Arlington Road, Wallasey.

WARE.—Cottage, laundry, and dynamo house, Easneye, for J. H. Buxton.

WARRINGTON.—Proposed new works; W. Hartley & Co., Ltd., Dairyfield Works, Heywood. Further extensions contemplated by Warrington Co-operative Society.

WELLINGBOROUGH.—Extensions to the Chrome Leather Works.

WELLINGTON (Salop).—Additions to New Street Wesleyan Church; the Trustees.

WESTHOUGHTON.—Rebuilding premises, after fire, for the Westhoughton Co-operative Society.

WHITBY.—Additions to Liberal Club. R. Lennard & Son, builders, Whitby.

WHITEHAVEN.—School (£10,000). Oliver & Dodgeson, architects, Lowther Street, Carlisle.

WHITLEY BAY (Northumberland).—Building and alteration of Redcar House. Write, 51, Percy Road, Whitley Bay.

WIDNES.—Fifteen houses, in Allerton Road, for E. Wood.

WIGAN.—Theatre. J. Thornley, Wigan.

WINCHESTER.—New county school for girls (£8,475).

WINSFORD (Cheshire).—Additions to the United Methodist Schools. A. Price & Son, architects, Sandbach.

WOLVERHAMPTON.—Extensions to Bingley Street Schools, for the Borough Education Committee (£4,888).

WOODNESBOROUGH (Kent).—Alterations and additions to Russell House, for H. E. M. Stanfield. S. H. Denne & Sons, builders.

WORCESTER.—Additions Victoria Institute. Cricket Pavilion, Worcester Grammar School; A. H. Parker, architect, The Cross, Worcester.

WORKSOP.—Offices, Carlton Road, for the Waterworks Co. Houses, bakery, stables, &c., Gladstone Street, for Mr. McCarrick.

WORTHING.—Eight houses in Lyndhurst Road; Apted, Greenfield & Co., builders, Worthing.

WRIGHTINGTON.—School. H. Littler, Ribblesdale Place, Preston, Lancs.

YEALMPTON (near Plymouth).—New Wesleyan Church (£1,030); Mr. Prowse, builder, Ermington, Ivybridge.

FORTHCOMING EVENTS.

Northampton Polytechnic Institute.—Friday, February 5th. At 7.30 p.m. Annual Prize Distribution by the Earl of Halsbury, and Students' Conversazione.

Saturday, February 6th.—At 6.30 p.m. Members and Students' annual Conversazione.

Institution of Electrical Engineers (Glasgow Section).—Saturday, February 6th. At 7.30 p.m. At the Grosvenor, Glasgow. Annual smoking concert.

Tuesday, February 9th.—At 8 p.m. Meeting at 207, Bath Street, Glasgow.

Northampton Institute Engineering Society.—Saturday, February 6th. Visit to the North Metropolitan Generating Station, Willesden.

Friday, February 12th. Paper on "A Modern Winding Engine," by Mr. Mr. E. A. Smart.

Institution of Mechanical Engineers (Graduates' Association).—Monday, February 8th. At 8 p.m. Lecture on "Interchangeability, and Methods of Securing it, in Screw-Threads," by Mr. H. F. Donaldson.

Institution of Electrical Engineers (Manchester Section).—Meeting of Tuesday, February 9th, postponed till Tuesday, February 16th.

Institution of Civil Engineers.—Tuesday, February 9th. At 8 p.m. Further discussion on Prof. B. Hopkinson's paper on "Heat-flow and Temperature-Distribution in the Gas Engine."

Faraday Society.—Tuesday, February 9th. At 8 p.m. At the Institution of Electrical Engineers. Papers on "Applications of Electrolytic Chlorine to Sewage Purification and Deodorisation by the Oxychlorides Process," by Mr. S. Rideal; and "A New Electrical Hardening Furnace," by Mr. E. Sabersky.

Institution of Electrical Engineers (Birmingham Section).—Wednesday, February 10th. At 7.30 p.m. At the University, Birmingham. Paper on "The Kapp-Hopkinson Test on a Single Direct-Current Machine," by Dr. W. Lulofs.

Association of Engineers-in-Charge.—Wednesday, February 10th. At 8 p.m. At the St. Bride's Institute, E.C. Paper on "Polyphase Motors for Machinery Driving," by Mr. H. B. Poynder.

Institution of Electrical Engineers (London).—Thursday, February 11th. At 8 p.m. At the Institution of Civil Engineers. Paper on "The Use of Large Gas Engines for Generating Power," by Messrs. L. Andrews and R. Porter.

Institution of Electrical Engineers (Dublin Section).—Thursday, February 11th. Meeting.

Physical Society.—Friday, February 12th. At 8 p.m. At the Royal College of Science, South Kensington, S.W. Annual general meeting. Presidential address.

Royal Institution.—Friday, February 12th. At 9 p.m. Discourse on "The Electrical Properties of Flame," by Prof. H. A. Wilson.

Junior Institution of Engineers.—Friday, February 12th. At 7.30 p.m. At the Royal United Service Institution, Whitehall. Meeting with the Architectural Association Debating Society. Paper on "Heat Transmission in Buildings," by Mr. K. Gray.

Signal Engineering Society.—Saturday, February 13th. At 7.30 p.m. At the Mansion House Station Restaurant, E.C. Paper on "The Board of Trade Requirements for Railways," by Mr. H. Raynar Wilson.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, February 8th.—"A" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7 to 10 p.m.

Tuesday, February 9th.—"B" Company. Infantry drill (recruits), 7 to 7.45 p.m. Technical drill, 7 to 9.30 p.m.

Tuesday, February 9th.—Medical inspection for recruits, 6.30 to 7.30 p.m.

Thursday, February 11th.—"C" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7 to 10 p.m.

Friday, February 12th.—"D" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7.15 to 9.30 p.m.

Saturday, February 13th.—Sergeants' Mess dinner.

(Signed) J. H. S. Phillips,
Capt. and Acting Adjutant.

INQUIRY COLUMN.

[Replies under cover to us should be accompanied by stamped envelopes ready for retransmission to our correspondents.]

A correspondent asks for the names of manufacturers or suppliers of Time-Limit Maximum-Current Cut-Outs, in suitable form for installing inside arc lamp cases.

Makers of Kupfer-Nickel Wire are asked for.

Makers of an Electric Magic Lantern for automatic advertising are inquired for.

NOTES.

The B. H. Thwaite Appeal.—We have received the following letter from Mr. W. H. Booth :—

"A short time back you inserted in your columns an appeal that is being made on behalf of the widow and young children of the late B. H. Thwaite, the discoverer of the epoch-marking fact that the waste gas of blast furnaces could be cleaned and made to serve in gas engines for power production.

"Just as the great discovery of Dr. Perkins in the coal tar industry was rejected by our English chemists and became a source of huge profit to the Germans, who had the intelligence and prescience to adopt Dr. Perkins's discoveries, so it has happened to Thwaite's invention. The Germans have again turned a weapon forged by an Englishman against ourselves. The gulf between their iron and steel industry and ours is being widened by the economic advantages that they quickly saw and as quickly seized when the invention was made known. When they suddenly found themselves possessed of energy representing nearly a million horse-power, they lost no chance of diverting such a fine asset into various useful and highly profitable channels. The proof of this is that more than half the available power, that is, over half a million horse-power, is in operation in Germany, derived on lines suggested and proved practically by Thwaite. We feel ashamed to have to quote our progress here. Out of an available energy of over 700,000 h.p. in Great Britain, we have utilised a little more than 20,000 h.p., say, about 5 per cent. of the German figure.

"In America, where the idea was only taken up at a long interval after its inception in Europe, a single concern has put down a plant nearly double the whole of ours put together.

"These are eloquent figures, and make bad reading for Englishmen. However, it has not arisen through any fault of Thwaite, whose hope was primarily to benefit his country, and who sacrificed his life in his efforts to do so.

"Be this as it may, we have not received from the British iron trade the support we feel the movement deserves, and our fund has no doubt suffered by the great Messina disaster. We still require about £200 before we can even claim from Mr. Carnegie the conditional £500 he has promised, and we therefore ask the favour of publicity through your columns, feeling confident that this further appeal will bring in the much-needed balance.

W. M. Mordey, M.Inst.C.E., President Inst.E.E.
W. H. Preece, Sir, Past President Insts.C.E. and E.E., F.R.S.
A. B. W. Kennedy, Sir, Past President Inst.C.E., F.R.S.
Robert Kaye Gray, M.Inst.C.E., Past President Inst.E.E.
J. O. Arnold, Professor of Metallurgy, Sheffield.
Harold Jeans (*Iron and Coal Trades Review*).
H. Alabaster (Electrical Review), 4, Ludgate Hill, E.C.
T. E. Gatehouse (Electrical Review), A.M.Inst.C.E., M.Inst.M.E. and E.E., F.R.S.E.
A. M. Sillar, M.Inst.C.E., M.Inst.M.E., M.Inst.E.E., hon. treasurer, 2, Queen Anne's Gate, S.W.
Hon. secretary, W. H. Booth, M.Am.Soc.C.E., 2, Queen Anne's Gate, Westminster, S.W."

Electric Shock Fatality in a Fife Mine.—The danger arising from interference with cables in coal pits by unskilled persons (to which attention was recently drawn by a letter in the Review) was forcibly illustrated by an accident in the Aitken Pit, Kelty, of the Fife Coal Co. Peter Beveridge, brusher, belonging to Dunfermline, met his death in the pit by coming in contact with a live cable, and an inquiry was held by Sheriff Shennan in Dunfermline on Thursday last week. The inquiry was attended by Mr. R. Maclaren, H.M. Inspector of Mines, and a number of other officials. Evidence was led at great length.

A contracting brusher, named Philp, stated that Beveridge (the deceased) and another workman named Gibbons, were engaged in lifting a pavement in the No. 5 siding, when an electric cable suspended from the roof became detached. Gibbons and Beveridge went to replace it. Gibbons was holding up the cable by means of a pick shaft, while Beveridge was tying it to the crossbeam. Suddenly Witness heard Beveridge cry out as if hurt, and looking towards where Gibbons and Beveridge were working, he saw the latter lying on his back. He was dead before he reached him. Efforts to restore respiration were continued for about half an hour. Examined by Mr. R. Maclaren, he said that they did not think about switching off the current before handling the wires.

According to the fireman, the men could not see properly, and Beveridge's naked chest came in contact with a wire hanging down. In reply to a juryman, one of the witnesses stated that no notices were put up warning workers not to interfere with the wires.

Dr. Tuke, Dunfermline, said he was satisfied that an electric shock was the cause of death, and he expressed the opinion that there had been prolonged application. The production of a piece of wire by Mr. Maclaren, showing a joint covered with string, satisfied him regarding the size of the burning marks.

Mr. John Clark, under manager, said they did not give definite instructions to the brushers regarding the cables, and any instructions given were only verbal. The method of joining the cable (produced in Court) was illegal. There was a casual inspection of the electrical installation below ground.

Answering Mr. Maclaren, witness said the piece of string tied round the cable was used by brushers in measuring wood, and it was likely it had been used for another purpose. In his opinion the twisting in the joining of the cable had not been done by a practical engineer, but by a novice, and it was done by someone unknown to the management.

Mr. George Russell, the principal electrician at the pit, said that as the motors had been taken out, he did not think a daily inspection at the place in question was necessary. The general efficiency of the plant was good. He tested the cables by running his fingers along them. He had examined cables carrying 450 volts, and had received shocks. The voltage at the pit head at the time of the accident was about 400. He disapproved of non-technical men interfering with the cables so far as the joining of them went, but he, as an electrician, would not object to the head of a gang of workers replacing a cable if it fell. If a fireman made a joint, it was examined. Generally, witness had time to do his duties.

Mr. Robert Nelson, mines electrician, of the Home Office, deposed that not merely the inspection arrangements, but the instructions or prohibitions relating to these, were inadequate, and such a condition of matters should not have existed. He thought that notices should be put up prominently to the effect that no unauthorised person should touch the cables. He further admitted the usefulness of special instruction being given to boys at school in regard to electricity in communities where 95 per cent. went to work in the pits. Asked if he approved of the method of testing the cable by means of the open hand, witness replied that it was the only method except by examining every inch of the cable. He explained that the method adopted by the electrician of the pit was merely to touch the wires with the tip of his fingers, and the electrician knew exactly what he was doing. He considered that the cables should be placed in positions where they might readily and efficiently be examined. None but skilled men should handle the cables when alive.

Mr. J. S. Soutar, Procurator Fiscal, said that if the mine owners were to use electricity, they should do so in such a way as to protect the workers against danger. If there had been a simple instruction to the brushers not to touch the cables, the accident would not have occurred.

Mr. R. Maclaren said the cause of the accident was the making of a faulty joint. He suggested that a notice should be issued at the pitheads that no unauthorised person should touch any electrical plant or cable in the mines. Mr. Macbeth, on behalf of the deceased man's relatives, said his opinion was that there was general slackness in connection with the supervision and the carrying out of the work.

Mr. D. L. Kerr, mining engineer, Glasgow, who represented the interests of the colliery owners, said there was not a manager in Fife who tried to do his duty and carry out the rules more than Mr. Beveridge, manager of the Aitken Pit. After the speeches of the Procurator Fiscal and others, one might think that mining could be carried out in a drawing room. Everybody knew that the elaborate precautions taken on the surface could not be carried out below. As to the notices, he reminded the Court of the continuous breach of the ordinary mining rules. While they might post up a notice, it was a different thing to get 1,000 men to pay attention to it.

The jury added to the formal verdict riders to the effect that the accident was caused by the deceased man's bare breast coming in contact with part of the electrical cable, which was imperfectly insulated owing to a badly repaired break; that they recommended that, in mines in which electricity was used, notices should be posted up prohibiting unauthorised persons from interfering with the wires, cables or other plant; and that they were of opinion that proper precautions had not been taken for the safety of the men by informing them of their danger.

Colliery Explosion.—As the result of an explosion at the Ackton Hall Colliery, Featherstone, whereby two miners lost their lives, an inquest was held. The evidence showed that the men were working near an electric fan, and one of the victims stated before his death that he was switching off the fan when the explosion occurred. The men were terribly burnt. The Chief Inspector of Mines for the Yorkshire district, Mr. Pickering, attributed the disaster to the unsuitable design of the switch box, which was not gas-tight, and the jury returned a verdict in accordance with his evidence.

The Inevitable.—It went without saying that a wireless airship had to be invented, and of course it has come—from America. It "made all kinds of evolutions." The inventor, a Mr. Anthony, is reported to have been enthusiastic over the results obtained. Two distinguished members of the British Empire Aerial League have pointed out the advantages of the invention. One, a military officer, explained that it was quite conceivable that one could get the batteries of an electric airship replenished, without the trouble of touching the earth at all, from wireless stations. But the airship might get blown up. The other remarked that the "wirelessly directed airship" would afford facilities for sending messages from airships to ships at sea—obviously a most important function. The reporter of the *Pall Mall*, unfortunately, neglected to secure the opinions of the Dormouse and Alice herself on the epoch-making discovery. The wireless electric cannon is hourly expected.

Re Improved Electric Supplies, Ltd.—The hearing of this case, which was reported on page 171 of our last issue, was continued on Wednesday last week, when Mr. H. P. Alison was further examined by MR. COLAM, and was taken in great detail through the disputed items in the stock-book. He said that several of the British Thomson-Houston fans were in a very dilapidated condition, none of them being marketable. The coils had been used, and several of them had burnt out. They had found six empty cast-iron frames, without any interior at all, these having been entered as motors. They had no armatures, field coils or brush gear, and were nothing more than cast-iron carcases. They had found a series of porcelain jars and plates, which had been valued as Gordon batteries; but they were of no service. The oil from the batteries had been used for lubricating machinery in the shop. 385 new copper reflectors had appeared in the stock-book, but all they found were about 350 copper-enamelled reflectors, dented, and with the enamel cracked off in many places. They sold them at ½d. each, the best offer they could get.

After a mass of evidence dealing with the different items in the stock-book, the case for the counterclaim closed.

On Tuesday, Mr. Acland, K.C., opened the defence to the counterclaim. Counsel argued that there was no agreement as to the value of the stock. The only agreement was as to the quantity. As to the suggestion that the defendants were turned out of the premises, counsel submitted that they were simply occupying the place as managers, and the trustee for the debenture-holders had a perfect right to evict them if they behaved improperly. He would call Mr. Thompson, who would refute a great deal of the evidence which had been given in support of the counterclaim, and as to any misrepresentation, defendants had absolutely failed to prove it.

Mr. Thompson, who negotiated with defendants on behalf of Mr. Muff and Snowden, was called. He denied that the stock-book misrepresented the quantity, quality and value of the goods described. At the time of the liquidation he had shown that they had orders on hand to the extent of £1,300, which were afterwards increased, and those orders were *bona fide* orders from *bona fide* customers. That was shortly before or after the liquidation, and was shortly before the sale went through, and the Witness left. All orders would be in the order book. He had stated that so far as he was concerned he would not sell the business under £7,500. He had never represented that the values in the stock book represented the market values when the stock was taken, but he had stated that the basis of it was practically the cost prices. April 18th was the last interview he had with regard to the business. He left all his papers of every class behind him. For the purpose of taking the stock of the accessories, the items were put down by the stock-keeper and afterwards identified as far as possible with the invoices. Occasionally it was not possible to trace an invoice, in which case the price would be estimated and afterwards rectified when it was found out. There were thousands of items in the stock list. They could not always find the invoices for each item, but they found the bulk of them. It was not true that some of the items in the stock-book had been purchased under cost price. Witness was then taken at great length through the disputed items in the stock-book.

Electrical Football League.—The following matches are down for decision next Saturday, the kick-off in each case being at 3 p.m.:—Metropolitan Electric *v.* General Electric, at Acton Lane, Willesden; Ediswan *v.* St. Pancras Electric, at Wormholt Farm, Pitch No. 8. The following is a table of matches played up to and including January 30th:—

Name of club.	Played.	Won.	Lost.	Drawn.	Points.
Metropolitan Electric F.C. ...	7	7	—	—	14
County of London F.C. ...	6	5	1	—	10
St. James' F.C.	8	3	3	2	8
General Electric F.C.	8	2	3	3	7
St. Pancras Electric F.C. ...	5	1	3	1	3
Robertson's F.C.	6	1	4	1	3
Ediswan F.C.	6	—	5	1	1

Direct Telegraphic Communication between England and India.—In the article on this interesting advance in our telegraphic communication with India, published in our last issue, we regret that several errors are shown in the illustrations. We can assure our readers that in both messages all the signals were quite correct, and that the mistakes shown were entirely due to the engravers. The originals of the illustrations can be seen at the offices of the Indo Co.

City and Guilds of London Institute.—The annual distribution of prizes and certificates took place on Friday last at the Mansion House. It was stated that some 50,000 students were attending classes registered by the Institute. Mr. Gerald Balfour delivered an address emphasising the necessity of technological training.

West Ham Annual Dinner.—The third annual dinner of the West Ham Electricity Department was held on Thursday, January 28th, at the Gaiety Restaurant, Mr. A. Hugh Seabrooke, the borough electrical engineer, presiding. The Mayor (Ald. Littler), the chairman of the electricity department (Ald. Crow), Mr. W. Fletcher (Wholesale Co-operative Society), Mr. Seabrooke, Mr. Stephen Sellon and others were responsible for speeches during the evening.

Appointments Vacant.—Telegraph and telephone inspector for the East Africa Protectorate (£160). See our "Official Notices" to-day. Junior assistant engineers for the Newcastle-upon-Tyne Electric Supply Co., Ltd.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—There were 127 applicants for the post of canvasser to the Fulham Electricity Committee, and out of seven local candidates who were interviewed, MR. W. T. HUMPHREY has been selected for the appointment at £2 10s. per week.

Gloucester T.C. on January 27th decided to terminate the appointments of MR. G. R. WHITE, electrical engineer, and MR. A. C. HEALEY, chief assistant and station superintendent. A motion to refer the matter back to the committee with the object of giving these officials an opportunity of resigning, was rejected by 18 votes to 16.

MR. ARTHUR SHAW has resigned the position of tramways manager at Ilford, but will retain the post of electrical engineer, his total salary being reduced by £100 a year. The U.D.C. will appoint a manager to devote the whole of his time to the tramway undertaking.

There were 193 applicants for the recently advertised post of shift engineer for Weymouth. MR. P. G. CAMPLING, of Middlesbrough, received the appointment.

In our last issue we published in this column a reference to the resignation of the Southwark borough electrical engineer which was received from our usual local correspondent. On the day of publication we received a telephonic message from MR. KINGHORN advising us that our information was inaccurate, but saying that he did not wish to enter into a discussion of the matter in the Press. It should be hardly necessary for the ELECTRICAL REVIEW to say that nothing is farther from its thoughts than to reflect unjustifiably upon the conduct of anybody, and least of all upon a municipal electrical engineer whose difficulties may be as numerous as his councillors. Therefore, in order that our readers may have an exact knowledge of what has transpired, we publish a full account of what occurred at the meeting of the Borough Council on Wednesday, this week, when the matter was under consideration. The report of the E.L. Committee read as follows:—

"*Coal Contract.*

"1. Your Committee beg to report that they have fully investigated the several matters that have arisen in connection with the contract for supply of coal to the electric light station during the past year, which has resulted in Mr. Kinghorn resigning his position as engineer and manager.

"With reference to the purchase of coal outside contract, your Committee would point out that in February last a serious fire broke out in the bunkers at the station lasting several weeks, which necessitated their being entirely cleared before any fresh coal could be stored, and there is every reason to believe that the fire was caused solely through the damp and unsatisfactory condition of the coal supplied under contract, rendering it liable to spontaneous combustion. This fire entirely disorganised the whole working arrangements of the station for several weeks, and it became necessary to request the contractors to cease sending coal for a time. When the supplies were resumed the engineer states that he found it necessary to purchase a better quality of coal to mix with that supplied under contract in order to get the full steam pressure.

"This coal was passed through the requisition book by the engineer, but in some cases the coal had already been ordered, and the engineer neglected to report either on his inability to get the full steam pressure from the contract coal or as to the purchases he had made, and, consequently, your Committee were not aware that orders had been given to the extent which the accounts subsequently showed.

"Your Committee are of opinion that this showed serious neglect on the engineer's part, for which he must be held greatly to blame.

"Your Committee were also much surprised, on perusing the correspondence that had passed between the electrical engineer and the contractors (which had not been brought to the notice of your Committee), to find that matters of serious dispute had arisen between them involving a claim of £110 7s. for demurrage on trucks detained beyond the time limit allowed for transit and unloading, and it was not till July last that your Committee had any knowledge of the matter, when the contractors addressed a letter to the town clerk calling attention to the difficulties that had arisen between them and the engineer, and intimating their intention of making a claim for demurrage on their trucks.

"In the opinion of your Committee, this was another serious neglect of duty on the engineer's part, who should have brought this correspondence (along with lengthy correspondence as to coal supply with other firms) before them and taken their instructions, instead of making the questions in dispute matters entirely between himself and the contractors.

"With reference to the claim for demurrage, your Committee felt that the best course to adopt under the circumstances was to refer the matter to the chairman and town clerk to endeavour to effect a settlement with the contractors, and your Committee are glad to be able to report a settlement of the claim at £40, and recommend that their action be approved.

"Resignation of Engineer and Manager.

"2. Your Committee have considered the letter of Mr. D. M. Kinghorn, referred from the Council, resigning his position as engineer and manager, and under all the circumstances, they have no alternative but to recommend that the resignation of Mr. D. M. Kinghorn, as engineer and manager of the electricity undertaking, be accepted, as from the 5th inst."

When the report was before the Council, the Rev. W. J. Sommerville inquired why a garbled report of the Committee had been given to the Press before it was presented to the Council.

Mr. H. Baguley said the report which appeared in one paper was grossly unfair and likely to injure their engineer. It was evident that what had been discussed in Committee must have been divulged by a member.

Alderman Hewitt, the Chairman of the Committee, said he very much regretted that he was unable to say who had divulged what had been done in Committee, although he had a strong suspicion as to who gave the information. He had tried to keep the deliberations of the Committee as quiet as possible in order to protect the engineer and the Council, but through the dishonourable conduct of some Committeeman his object had been frustrated. The report, which appeared in one electrical paper, was exaggerated and untrue, and likely to injure a man when attempting to get another appointment. It was a most cowardly attack upon the engineer, and he, as well as nearly every member of the Council, deeply regretted it.

The report was then adopted.

We leave it to our readers to judge from the foregoing report how accurate was our last week's information. Certainly we made no attack on the engineer.

Tramway Officials.—To mark the retirement of Mr. A. E. Blower from the post of traffic superintendent to the Doncaster Electric Tramways, the electricity staff on Saturday last (January 30th) presented him with a marble clock.

The directors of the Douglas Southern Tramways have appointed Mr. Reginald Orton, assistant manager to the Coventry tramways, to the managership of their system.

General.—At the annual dinner of the National Telephone Co.'s Glasgow staff on January 29th, Mr. Douglas Watson was presented with a silver rose bowl on the completion of 25 years' service, Mrs. Watson being the recipient of an opal and diamond pendant.

It is stated in the *Times* that Lord Rayleigh, having been taken seriously ill in South Africa, will not go to Australia as intended, but will probably finish the winter in Egypt.

Messrs. O'Gorman & Cozens-Hardy announce that they have joined with Messrs. Swinburne, Cooper & Baillie, and under the new title of Swinburne, O'Gorman & Baillie they will continue to practise as consulting engineers in electrical, automobile and general work at 82, Victoria Street, Westminster, S.W.

Mr. W. R. Cooper announces having severed his connection with Messrs. Swinburne, Cooper & Baillie. He will continue to practise as consulting engineer in electrical and mechanical engineering and experimental work at 82, Victoria Street, S.W.

Mr. F. W. Hartmann, A.M.I.E.E., assistant managing director of the Langdon-Davies Motor Co, Ltd., was recently married at St. Margaret's Church, Westminster, to Miss Dorothy Rose, daughter of Mr. and Mrs. Henry Nye, of the Manor House, Broadwater, Worthing. The guests were received at the Grosvenor Hotel, where a string band of the Royal Engineers played, Mr. Hartmann being a lieutenant in the Electrical Engineers' Battalion.

The *Times* states that the French Government has decided to bestow the medal for saving life upon Mr. Jack Binns, the wireless operator on board the liner *Republic*.

Mr. C. Salmon, late of Garnett's Cable Co., has joined the staff of Messrs. I. Frankenburg & Sons, Ltd., electrical wire and cable makers, Salford, Manchester, and he will represent them for the sale of vulcanised bitumen and rubber insulated cables.

On the 17th and 18th inst. Mr. Chas. Bright, F.R.S.E., will deliver two lectures on "Submarine Telegraphy in its Relation to the Navy and Warfare," at the Royal Naval War College, Portsmouth.

Obituary.—In our last issue a mention was made of the death of Mr. Harold Hincks, A.M.I.E.E., of Wrexham. We now learn that his death occurred suddenly at Plas Gwyn, Minera. Deceased, in 1894, became chief assistant electrical engineer to Dr. N. S. Keith at the Sandycroft Foundry and Engine Works Co., and in 1898 he secured the appointment of electrical engineer to a group of 10 mines on the Kolar goldfields.

We deeply regret to record the death, which occurred on January 30th, after only a few hours' illness, of Mr. William Winstanley Strode, A.M.I.E.E., at the age of 58 years. Mr. Strode was of the well-known firm of Strode & Co., electric light engineers, of 48, Osnaburgh Street, N.W., and other addresses in London. The deceased gentleman passed away at Pole House, King's Langley, where the funeral took place on Wednesday afternoon. Carriages met the 1.45 p.m. train from Euston to convey from London friends who were attending the ceremony.

CITY NOTES.

Metropolitan Railway Co.

In the course of an interesting speech at the half-yearly meeting of this company last week, Sir Charles McLaren, Bart., M.P., said that carriage and wagon repairs showed an increase of £1,382, due to the fact that they had lately been renovating a considerable number of old compartment carriages with a view to running them by means of electric locomotives between Baker Street and Harrow. The traffic on this line was developing in a most satisfactory way, and it was necessary not only to increase the number of trains, but also to provide more seating accommodation in the morning and evening. Referring to the item of £17,000, proposed to be added to the electrical renewal and depreciation fund (as against £6,000 in the corresponding half-year), he said the board were quite satisfied with the way in which the electrical machinery had worked, and with the cost at which current had been produced. At the same time, in electrical machinery, and turbines especially, cost-saving improvements were continually being made, and it might be necessary for reasons of economy before the present machinery was anything like worn out to supersede it by something more up-to-date and efficient. They might be called upon, possibly at short notice, to make some heavy repairs or alterations which could not be foreseen. In such an eventuality the board would be justly blamed if they should be forced to reduce the dividend seriously, whereas by building up an adequate reserve for such a contingency they hoped to secure a steadier, as well as an improved, dividend. A good deal of extra revenue during the past half-year having been derived from the Franco-British Exhibition, the directors thought it well to put all they could out of the earnings of the six months to the fund in question, to make up to some extent for what they had been unable to do during the last two or three years. The fund now stood, with the addition proposed, at £47,450 and very materially strengthened the financial position. A very satisfactory increase was shown in season ticket traffic, undoubtedly induced by the frequent and more regular train services. On October 1st practically the whole of the train services were revised, with eminently satisfactory results. The rearrangements, while giving the public a greatly increased and improved service, had involved very little additional cost, and had enabled them to keep up a punctuality which had not existed since the introduction of electric traction. Punctuality was a point upon which the credit of the line very largely depended. This would be further assisted by the installation of automatic signalling on the inner circle line, the last section of which would be finished within the next few weeks. The board had every reason to think that they had at last got to the end of the time of depression, and that the prospects were better than for some time past. They had no further capital expenditure of any moment immediately before them. The ordinary daily traffic was steadily growing, and they were now feeling the benefit of the large development in the travelling habit of the people of London, induced by the enormously greater facilities provided during the last few years. The increase of traffic was continuing in the present half-year, and residential districts served by the line were developing quickly at various points. They were laying themselves out for dealing as never before with parcels traffic, and were finding a very satisfactory response on the part of stores and other large establishments who appreciated the quick deliveries secured. With regard to expenditure, considerable economies had been effected during the last few months, and others were in view. A satisfactory contract had been made for power house coal for the current year, which would ensure a material saving. Taking all these things into account, they felt that they were justified in looking forward to a gradual but decided improvement in the position of the company.

Typewriting Telegraph Corporation, Ltd.

The directors' report for the 20 months from April 1st, 1907, to November 30th, 1908 (the latest date to which it was practicable to bring them down), states that unfortunately very few sales have been made during the period, and although expenses of management and labour have been kept at the minimum, the loss for the period is still very considerable. In the profit and loss account will be noticed an item of £192 for debenture interest, of which £163, representing the interest accrued during 17 months, has not been paid. Prior to the meeting of shareholders a meeting of debenture-holders will be held, and the decision arrived at by the debenture-holders will be reported to the shareholders at the general meeting.

A representative of the Electrical Review on applying for admission to the eighth ordinary general meeting of this company, which was held on Wednesday at the offices, 72, Bishopsgate Street Within, was informed that "there was no accommodation for the Press."

Mexican Light and Power Co.

The report of this company, as quoted in the *Times*, states that during the past year the actual and prospective demands for power, in the centres of consumption supplied by the company, have increased beyond the directors' most sanguine expectations, and to meet these demands it has been decided to double the capacity of the present hydro-electric plant at Necaxa during the next three years, and to bring into the Necaxa Basin, by a series of diverting and storage dams, canals and tunnels, the waters of the Lower Tenango, Nexapa and Catepuxtla rivers, which are included in the water rights granted to the company by the Federal Government of Mexico, but which rights it was not, until recently, believed that the company would have need to exercise for many years to come. The gross earnings for the year 1908 were $2,938,474 gold, and the operating and maintenance expenses $1,080,570. The expenditure on properties during the past year includes the cost of acquiring the business and undertaking of the Robert Electric Co., which was

taken over in November last, at a price considerably less than previously estimated. Inasmuch as surplus earnings to the amount of $1,486,710 gold were accumulated prior to December, 1908, during the period of construction, the board, rather than distribute the surplus in dividends, has deemed it advisable to write off the following sums:—For increased cost of construction due to drought and other special conditions, $478,789; appropriation for depreciation in transformers, meters, electric supplies, &c, acquired on purchase of other companies, $100,000; appropriation for bad and doubtful debts due to the company, $47,414. Out of the earnings of the past year 3½ per cent. has been paid in dividends on the ordinary shares, and on December 31st last a balance of $910,823 gold was carried forward.

Great Northern and City Railway Co.

The directors' report for the half-year ended December, 1908, states that the total revenue receipts for the six months were £38,827 and the cost of working £21,813, being at the rate of 56·18 per cent. Inclusive of the balance brought forward, the net revenue amounts to £17,433, which is insufficient to meet the company's fixed charges for the half-year. The sum of £5,596, which has been provided from outside sources, has enabled the company duly to meet these charges. The number of passengers for the six months, including season ticket holders, was 5,533,697, as against 7,543,174 for the corresponding period last year, and is the lowest of any corresponding half-year since the opening of the line. The number of local season tickets issued during the half-year was 3,178, as against 3,703. The number of three-route season ticket holders using the line was 2,200. The severity of the competition to which the company has been subjected for over a year continues unabated. Unquestionably the most important factor in the diversion of the company's traffic is the ever-increasing service of electrified tramcars provided by the London County Council, against which the company finds itself almost powerless.

Anglo-American Telegraph Co., Ltd.

The directors report that the total receipts from July 1st to December 31st, 1908, including the balance of £6 963 brought forward, amounted to £209,603. The traffic receipts show a decrease of £5,423 as compared with the half-year ended December 31st, 1907. The working expenses of the half-year, as shown by the revenue account, amounted to £79,037, being an increase of £5,581, as compared with the corresponding period of 1907. The directors, under the powers conferred upon them by the articles of association, have, before declaring the net profits, set apart the sum of £10,000 to the renewal fund, leaving a balance of £120,565. Quarterly interim dividends of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, were paid on November 2nd last, absorbing £52,500, leaving a balance of £68,065, out of which the directors recommend the proprietors to declare final dividends of 19s. per cent. on the ordinary stock, £1 10s. per cent. on the preferred stock, and 8s. per cent. on the deferred stock, payable on February 6th, amounting together to £66,500, making a total distribution for the year ended December 31st 1908, of £3 4s. per cent. on the ordinary stock, £6 per cent. on the preferred stock and 8s. per cent. on the deferred stock. The balance of £1,565 will be carried forward.

Liverpool Overhead Railway Co.

For the half-year ended December 31st, 1908, the directors report that the gross revenue receipts amount to £37,167, and the working expenses to £29,159.

The number of passengers carried during the last two years is as follows:—

	Half-year, June, 1907.	Half-year, Dec., 1907.	Half-year, June, 1908.	Half-year, Dec., 1908.
First-class	615,690	635,086	597,981	566,162
Third-class (incldg. trnwys.) ..	3,190,871	3,529,291	3,059,757	3,204,822
Workmen (special rtrn. tkts.)	1,617,034	1,640,252	1,709,548	1,396,480
Total	5,423,595	5,804,629	5,367,286	5,167,464

The traffic during the past half-year has again been disappointing, the total number of passengers carried being 5,167,464, against 5,804,629 in the corresponding half of last year. Of this large decrease, 243,772 represents the reduction in the number of special return tickets issued to workmen. The decrease in traffic is attributable mainly to the depressed condition of trade, but the company has also suffered by the increased competition of the Corporation tramways. Mr. S. B. Cottrell resigned his position of engineer and general manager, and Mr. E. J. Neachell, who has been acting as sub-manager and engineer for some years, has been appointed in his place. The accounts show that the directors have been able to effect some reductions in working expenses; the effect of these will, however, be more apparent during the current year. The rolling stock and permanent way have been carefully maintained, and are in good working order and condition. The receipts from passenger traffic amount to £36,204; miscellaneous receipts and interest, £963 = £37,167; less working expenses and transfer to renewal fund, £29,158; leaving, £8,009. After deducting interest on mortgage debentures, and on calls paid in advance (£4,329), and adding £4,207 brought forward, there remains available for dividend, £7,886. The directors recommend dividends at the rate of 5 per cent. per annum (less income-tax) on the preference shares, payable on and after February 11th next, leaving a balance of £4,210 to be carried forward.

Metropolitan District Railway Co.

The directors' report for the half-year ending December 31st, 1908, states that the expenditure on capital account during the half-year was £76,924, but after deducting £130,000 received from the sale of cars to the London, Tilbury and Southend Railway Co., there is a net credit to capital account of £53,076. The revenue has increased in a most satisfactory manner, and the increases have occurred practically throughout the entire system. It is estimated that the additional revenue directly attributable to the Franco-British Exhibition has been about £10,000. The gross receipts in revenue account No. 9 amount to £261,874, being an increase of £37,411 on the receipts for the corresponding half of 1907. The working expenses amount to £153,868, being a decrease of £2,201. After providing for interest and other charges, the net revenue account shows a credit balance of £11,613, and the directors recommend that a dividend at the rate of £1 15s. per cent. per annum be declared on the 4per cent. guaranteed stock payable on February 12th. The following table shows the working expenditure in comparison with the corresponding period of last year:—

	Half-year, Dec. 31st, 1908.	Half-year, Dec. 31st, 1907.	Increase or decrease.
Maintenance of way and works	£25,062	£24,002	+£1,060
Maintenance of rolling stock	19,556	22,583	— 3,027
Train working and traffic expenses (including joint stations), after deducting the balance of accounts for work done for and by other companies ..	80,159	75,489	+ 4,670
Rates and taxes (including joint stations)	17,350	20,192	— 2,842
Other items	11,741	13,803	— 2,062
Total	£153,868	£156,069	£2,201 = 1·41 %

The following table gives a summary of comparative figures for the second halves of the years 1907 and 1908:—

	Half-year, Dec. 31, 1908.	Half-year, Dec. 31, 1907.	Inc. or dec.	Or p.c.
Passengers, including workmen and season ticket hldrs' jrneys	31,503,722	25,808,732	+5,694,990	22·07
Passengers at workmen's fares	5,727,058	4,817,208	+909,850	18 89
Passenger receipts ..	£248,117	£204,882	+£38,235	18·66
Average receipt per passenger ..	1·85d.	1·91d.	−·06d.	3·14
Train-mileage on District Rlway	1,519,673	1,225,223	+294,450	24·03
Car-mileage on District Railway	6,167,698	5,292,478	+875,220	16·54

During the half-year £550,000 of the authorised prior lien debenture stock has been issued on satisfactory terms, and, out of the proceeds, the whole of the temporary loans on the security of the company's surplus lands, have been paid off. The prior lien debenture stock was issued as redeemable at any time after December 31st, 1920, at the price of £105 for every £100 of stock. At the time when the railway was equipped for electric working, this company provided the whole of the rolling stock required for working, not only their own railway, but also the Whitechapel and Bow Railway, and a portion of the London, Tilbury and Southend Railway. In the directors' report of February last, it was stated that terms for the use of the District cars on the Tilbury Railway had been settled with the Tilbury Co. for a period of five years. Since then, further negotiations have taken place, and the Tilbury Co. have recognised the fairness of their bearing part of the capital expenditure involved in the provision of rolling stock. They have purchased 37 motor-cars and 37 trailer cars for a sum practically equivalent to cost price. The amount received from the Tilbury Co. for the cars so purchased, viz., £130,000, has been credited to capital. The sale of cars to the Tilbury Co. having been arranged since the estimate of capital requirements was prepared for the purpose of fixing the amount to be raised by the issue of prior lien debenture stock, the directors consider that, in the altered circumstances, they ought not to issue £130,000 of the unissued balance of £200,000 prior lien debenture stock under the powers of the Act of 1908, without the consent of a majority of the holders of the debenture stocks of the company ranking behind the prior lien debenture stock, and if it should hereafter become necessary to raise moneys for capital expenditure by the issue of the above-mentioned amount of £130,000 prior lien debenture stock, such consent will be sought before the issue is made. The directors recommend that Mr. W. C. Burton be elected a director.

London Electric Supply Corporation, Ltd.

The report of the directors for the year ended December 31st, 1908, shows that the profit on the working for the year is £53,209 against £46,320 last year. To this has to be added the amount brought forward—viz., £2,837 less interest on temporary loan—viz., £1,481, making a total of £54,565. Out of this the interest on debenture stock to December 31st—viz., £15,215 has been paid, leaving a balance of £39,350 to be appropriated. The board propose a dividend of 6 per cent. on the preference shares (of which an interim dividend of 3 per cent. was paid on September 1st, 1908), requiring £20,952; a dividend of 3 per cent on the ordinary shares, £9,990; placing to reserve account (making a total of £62,500), £5,000; carrying forward £3,408. The supply of current has been efficiently maintained during the year. The number of units sold amounted to 13,160,130, as against 10,011,987 last year; the total

costs per unit sold being 1·09d., as against 1·42d. last year—a reduction of 23 per cent. Out of the total number of units sold, 7,746,653, or 58 per cent., were sold for power (as distinguished from lighting) purposes, at an average price of ·93d. per unit. The L.B. and S.C. Railway commenced taking a supply for experimental working in connection with the electrification of their South London line on January 17th, and the consulting engineer of the railway has written saying that "the whole of the arrangements in connection with the trial runs work quite satisfactorily." The plant in connection with this important contract has been erected. Authority was granted on February 21st, 1907, to increase the capital of the company by an issue of 20,000 new preference shares of £5 each to provide this plant; but owing to the times being unpropitious for such issue, the necessary capital for this purpose has been partly provided by a temporary loan from our bankers. Now that Parliament has settled the question of power supply in London, an opportunity will be taken of making this issue for the purpose of paying off this loan and for providing further plant in response to increasing demands for power for electric traction and industrial purposes generally. The plant and machinery have been maintained out of revenue and are in an efficient condition. The Bill promoted by this corporation, in association with other electric supply companies in London, for conferring further powers upon all the companies in order to obviate the necessity for, and to take the place of, the various power Bills which have been promoted during the last three Sessions, received the Royal Assent on December 21st last. This Act enables this corporation to associate not only with other companies, but also with the local authorities, for common economy and the public benefit. It also confers powers upon them to supply railways which run outside their areas. Moreover, Parliament having rejected the Bills of promoters who sought to introduce additional competition, those companies who are already in the field are at last able to count on being freed from heavy annual Parliamentary expenses, and are permitted to utilise their position to the best advantage. The directors record the death of Sir William Pollitt; it is not proposed to fill the vacancy on the board at present.

The following note shows at a glance the results of working for the year ended December 31st, 1908, compared with those of the previous year:—

	Units sold.	Net revenue.	Dividend on ordinary shares.	To reserve.	Carried forward.
1908 ...	13,160,130	£53,209	3 %	£5,000	£3,408
1907 ...	10,011,987	£46,320	2½ %	£2,500	£2,837

Rees Roturbo Development Syndicate, Ltd.

The annual meeting of the above syndicate was held at the works, Wednesfield Road, Wolverhampton, on Friday last. Alderman C. T. Mander presided.

The directors, in their report for the year ending December 31st, 1908, showed a balance standing to the credit of the profit and loss account of £1,808. Out of this they proposed to pay a dividend at the rate of 2½ per cent. per annum, less income-tax, absorbing £712, and to carry forward £1,095. This report is for the second year of the company, and the progress shown is exceedingly satisfactory. The profit shown is secured from royalties on pumps supplied by the English Manufacturing Co., and the royalties for the second six months of the year show an increase of approximately 40 per cent. over the royalties received in the first six months of the year. The value of the orders on the books of the Manufacturing Co. on January 1st, 1909, for Roturbo pumps amount to over 50 per cent. of the total output in pumps for the past year, so that there is every probability of the ratio of increase of output and profits being maintained during the ensuing year's work. Negotiations are still pending for the sale of manufacturing rights of Roturbo patents in foreign countries and the Colonies, but the directors have hitherto not considered it policy to hurry these negotiations, as each year in the early stages of the development makes the rights more valuable, due to the larger amount of practical work done, which is necessary before a fair estimate of their value can be determined. These negotiations at the present time cover America, Canada, France, Belgium and other Continental countries, and pumps have been running in these countries for some considerable time very satisfactorily demonstrating the advantages secured under these patents. Considerable progress has been made in the development of the Roturbo air pump and condensers, but sufficient time has not elapsed for any of them to have been placed on the market, although Roturbo vacuum pumps are in practical work at the Manufacturing Co.'s works. The Rees Roturbo Manufacturing Co., Ltd., was registered in October, and now holds the manufacturing licence from this company for Great Britain and Ireland.

The Chairman, in moving the adoption of the report, said that the dividend was only 2½ per cent., but it was a good beginning, and they proposed to carry forward nearly £1,100 to next year's account, or an amount equivalent to another 3½ per cent. They thought it wise to commence at once a policy to keep back more than they paid out in dividends until they had accumulated sufficient reserve fund to secure the capital. Comparing the present with last year's balance-sheet, the progress had been very steady and satisfactory, and the patents which this company was formed to develop being comparatively recent ones, they would get the benefit of practical working for the whole term of the patents. These patents had now been published and machinery built under them sufficiently long to have thoroughly tested their validity and advantages. Each month strengthened the opinion the directors formed of this group of patents when it was decided to form this company to exploit them, and the number of applications for sale and manufacturing rights which they were receiving from all over the world, was a very pleasant confirmation of the opinion engineers and experts had formed as to their utility. With regard to future work, the Manufacturing Co.'s books showed a rapidly increasing trade in Rees Roturbo machines. It appeared likely that the present year would see a considerable increase in the royalties received, and that they would be able to pay increasing dividends in the future.

The resolution was seconded by Mr. J. E. Underhill, and carried.

Mr. E. S. G. Rees was re-elected a director.

Prospectuses.—*The South Metropolitan Electric Light and Power Co., Ltd.*—The list was to close yesterday in an issue at par of 50,000 6 per cent. cumulative second preference shares of £1 each, ranking both for capital and dividend in priority to the ordinary shares, and next after the 7 per cent. first preference shares. Existing shareholders and consumers of the company will have preference in the allotment. The reasons for the issue and the scheme of the share capital re-arrangement were given in detail at the recent meeting of the company. (See Electrical Review, January 22nd, 1909, page 148.)

Mexico Tramways Co.—From Monday to Wednesday last applications were being publicly invited by the Bank of Scotland for £1,250,000 six per cent. 50-year mortgage debenture bonds at 96½ per cent. in denominations or £100 each. This is part of an authorised £2,000,000 in the same class. There are already issued $9,000,000 first mortgage 5 per cent. gold bonds. The particulars of the company's undertakings are set out in the prospectus. The proceeds of the issue will be available for extensions and development of the tramway lines, and additional equipment for same, and for other purposes of the Tramway Co., as well as for providing additional capital in co-operation with the Mexican Light and Power Co. for the completion of the hydro-electric development now in hand.

Dublin and Lucan Electric Railway Co.—The directors report that the gross receipts for the half-year to December 31st, 1908, were £3,734, being £157 in excess of those of the corresponding period of last year. After providing for debenture interest there is an available balance of £1,122. The usual half-yearly dividend on the 5 per cent. preference shares is recommended; £150 is to be paid to the contractors on electrical equipment account; and the balance of £497 is to be carried forward to next half-year, as against £512 carried forward in the previous year. A resolution will be moved at the half-yearly meeting of shareholders, to be held on February 18th, to enable the directors if they shall so think fit, and upon such terms and conditions as they may approve, to enter into a lease for the working of the proposed extension (when made by an independent company) of the line from Lucan to the Spa Hotel, the construction of which has been authorised by a recent Order in Council.

City of London Electric Lighting Co., Ltd.—The directors have resolved, subject to the completion of the audit, to place the sum of £45,500 to reserve, and to recommend dividends as follows:—On the preference shares 6s. per share for the half-year ended December 31st, 1908, making, with the interim dividend, a total of 12s. per share, or 6 per cent. per annum; on the ordinary shares 7s. per share, making, with the interim dividend of 5s. per share, a total of 12s. per share for the year ended December 31st, 1908, or 6 per cent. per annum. A balance of about £26,500 will be carried forward. Both dividends will be subject to the deduction of income-tax.

Jamaica Telephone Co.—At the annual meeting of the above company a report was submitted showing that the net revenue for the year was £809, and that a further sum had been expended during the year on account of the earthquake. This, with £1,726 spent last year, would make the total expenditure to date on account of the disaster, £1,913. The statement of profit and loss showed that the debit had been reduced to £521, and would be almost covered by the amount to be received for insurance, leaving a comparatively small balance to be met by revenue of the coming year. Under the circumstances no dividend would again be paid this year. The report was adopted.—*Jamaica Daily Telegraph.*

Stock Exchange Notice.—Application has been made to the Committee to allow the following securities to be quoted in the Official List: County of London Electric Supply Co., Ltd.—Further issue of 1,171 6 per cent. cumulative preference shares of £10 each, fully paid.

Central Electric Supply Co., Ltd.—The directors recommend a dividend of 5 per cent. (5s. per share) on the ordinary shares for the year, carrying forward £23.

Austria-Hungary.—The Ungarische Elektrizitäts Gesellschaft, of Budapest, reports that it has disposed of its electric lighting undertakings in the towns of Fiume and Erlau to the municipalities. A dividend of 9 per cent. is being declared, as compared with 8 per cent. in the preceding 12 months.

MARKET QUOTATIONS.

Wednesday, February 3rd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	29/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal)	per ton	£33 10	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Copper Sulphate	„	£21	..
a Lead, Nitrate	„	£23 10	..
a „ White Sugar	„	£23	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a „ Chlorate	per lb.	8½d.	..
a „ Perchlorate	„	9d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt	85/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %)	„	£10 15	..
a „ Chlorate	per lb.	3½d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	8d.	..
a „ Cyanide (basis 100 %)	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£70	..
b „ Wire, in ton lots	„	£112	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£50 to £135	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¼d.	¼d. dec.
c „ Tube (brazed)	„	8¼d.	¼d. dec.
c „ „ (solid drawn)	„	7¼d.	¼d. dec.
c „ Wire, basis	„	6¾d.	¼d. dec.
c Copper Tubes (brazed)	„	8¼d.	¼d. dec.
c „ „ (solid drawn	„	9¼d.	¼d. dec.
g „ Bars (best selected)	per ton	£72	£2 dec.
g „ Sheet	„	£72	£2 dec.
g „ Rod	„	£72	£2 dec.
e „ (Electrolytic) Bars	„	£63	£2 10 dec.
e „ „ Sheets	„	£79 10	£2 10 dec.
e „ „ Rod	„	£67 10	£2 10 dec.
e „ „ H.C. Wire	per lb.	8¼d.	¼d. dec.
f Ebonite Rod	„	3/3	..
f „ Sheet	„	3/-	..
n German Silver Wire	„	1/6	..
h Gutta-percha, fine	„	5/6 to 6.6	..
h India-rubber, Para fine	„	5/1	..
i Iron Pig (Cleveland warrants)	per ton	48/6	..
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead English Ingot	„	£13 5	dec.
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£8 7 6	..
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	1/0½ to 1/2	..
p „ „ rolled bars & rods	„	1/2½ to 1/3½	..
p „ „ rolled strip & sheet	„	1/8 to 1/6	..
o Platinum	per oz.	100/-	variable.
e Silicium Bronze Wire	per lb.	9½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£127 to £128	£10 dec.
n „ Wire, Nos. 1 to 16	per lb.	1/9	½d. dec.
p White Anti-friction Metals:—			
"White Ant" brand	per ton	£35 to £60	..
k Zinc, Sh't (Vielle Montagne bnd.)	„	£25 5	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

National Gas Engine Co., Ltd.—The directors report that for the year ended December 31st, 1908, the net profit, after providing amply for depreciation of buildings, tools, &c., and allowing for management salaries and income-tax, is £44,986. An interim dividend for the six months to June 30th, amounting to £18,169, being at the rate of 5½ per cent. per annum on the preference shares and 20 per cent. per annum on the ordinary shares, was paid on July 31st, 1908, leaving a balance of £26,817, which, added to £16,311 brought forward from last year, makes a total of £43,128 to be dealt with. The directors recommend a final dividend at the rate of 5½ per cent. per annum on the preference shares and 20 per cent. per annum on the ordinary shares, both less income-tax, for the six months ended December 31st, 1908. This will absorb £18,169 and leave £24,960, of which the directors propose to place £10,000 to the reserve fund (making it £90,000) and to carry forward £14,960.

STOCKS AND SHARES.

Tuesday Afternoon.

INVESTMENT business is attracting more attention in the Stock Exchange than speculative, but it cannot be said that even of the former there is any too much about. The position of the Money Market has again assumed a prominent part in the Stock Exchange drama—tragedy or farce. According to personal experience, so must the label be.

Consols have moved up, taking in their train many of the principal Home Railway stocks. More animation than usual has lately characterised Home Rails, but the favourable changes in electric securities are confined to Metropolitans and Districts. The Central London group is weak, and has lost all the transient brightness gained in consequence of the dividend announcement. The Deferred stock has fallen 3, to 48. None of the Central London quotations are *ex* dividend yet. City and South London is marked down 1, of which ¾ is accounted for by the dividend. Metropolitan Consolidated, on the other hand, is ½ up at 3s. *ex* 5s. dividend, while the Surplus Lands stock has recovered part of the deduction, and Districts show a rise of ½ at 14½.

Underground Electric Railways 4½ per cent. Bonds reacted a point after their sharp rise, but the newer Tube Debenture stocks remain firm, and Charing Cross 4 per cent. at 90 is 1 to the good. The trial trip over the just-completed electric section of the London, Brighton and South Coast Railway led to a rise in the price of the Deferred stock, which now stands about 87½, including in its price the dividend for the full year 1908. Great Northern and City shares did not change when the report appeared the other day showing the unfortunate concern to be in a worse position than ever, owing to the competition of the L.C.C. trams.

Electricity Supply shares could hardly be quieter than they are at the present time. Barely a ripple stirs the placid calmness of what may aptly be termed a frozen market. Westminsters are easier; so, too, are St. James's, and this despite the intermittent fogs. Amongst provincial shares, Newcastle-on-Tyne Ordinary are again flat, the Ordinary and Preference both declining.

What dulness there is in the home supply group is in one way compensated for by much vivacity in the Canadian-Mexican division. Further shaking-out of the weaker holders, and perhaps a little attention to the relative dearness of the shares, pointed out here last week, caused the price of Mexican Light and Power to drop 3 points, half of which it subsequently recovered. The Preference fell 3½ and the bonds 2½, but the latter are *ex* the interest.

Mexico Tramways at 142½ have more than regained the dividend of 1½ per cent., but Rio Trams are very much more in the ascendant at 98½, which represents a gain of 8. Rio bonds are 92½, which is ¾ point lower than the Mexico Tramway bonds. These last have been rather overshadowed by the issue of 6 per cent. bonds by the company at 96½, and inquiry was raised, without receiving a satisfactory answer, as to why such apparently good terms had to be offered. The issue was underwritten months ago. Shawinigan Water and Power issues have attracted a little notice, the capital stock being dealt in about 95½, the 5 per cent. bonds at 106¾ and 106¼ and the 4½ per cent. Mortgage Debenture stock at 95. Sao Paulo Trams drooped to 163.

London United Tramways Preference shares have gained another half-a-crown, and the Debenture stock a point, the buying being vaguely associated with that which has caused the recent advances in Underground Electric Railways descriptions and in District stock. Other tramways issues are without much interest as regards the quotations. Anglo-Argentines receded a little.

Anglo-American Telegraph Deferred has gone still further lower, on the disappointment over the dividend, and Direct United States are duller. Anglo Preferred, however, has risen 1. Cuba Telegraphs are better; Amazon Telegraphs hardened. The Eastern group is unaltered. Marconi's are the chief feature in the Telegraph Market, the system receiving a splendid advertisement from the part played by wireless telegraphy in the summoning of aid to the *Republic*. West Coast of America shares are ¼ better, and West India Ordinary gained a diminutive fraction.

Manufacturing shares are quiet; Babcock & Wilcox came into prominence at 4 bid. British Insulated shares are harder, but Telegraph Constructions lost their last week's rise.

The National Telephone Company's dividend declaration at the rate of 6 per cent. per annum on the Deferred stock, with substantial appropriations to renewals and reserves, met general expectations, and the only changes were falls of 1½ in the price of the Deferred, and of 5s. in that of the First Preference. We may, perhaps, be forgiven for relating how a certain daily paper misquoted the Deferred stock *ex* dividend early last month, and so led a holder into selling. When the gentleman found out the newspaper's mistake, the atmosphere in the city editor's office was, for a little while, on the verge of lurid, the irate proprietor going up in person to "see about" the business, and it was some time before the staff could induce him to ring off his perfectly justifiable eloquence.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME,	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Jan. 26th.	Closing Quotations Feb. 2nd.	Business done week ended Feb. 2nd, 1909. Highest	Lowest.	Rise + or Fall −	Present Yield per cent.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	2⅜ — 2¾	2⅜ — 3¼	..	..	+ ¼	£ s. d. Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	99 — 95	99 — 95	..	..	..	5 3 1
$121,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	..	128 —131	128 —131	..	..	..	6 2 2
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	94 — 96	94 — 96	94½	..	..	4 8 4
598,180	Anglo-American Telegraph	Stock	3½%	3½%	3½%	£3 4s.	54 — 57	54 — 57	..	..	..	5 12 6
2,300,210	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	96 — 98	97 — 99	98⅝	97⅝	+1	6 3 9
2,300,210	Do. do. do. Deferred	Stock	½%	1½%	1 %	8/-	13⅜ — 13⅝	1⅞ — 13⅛	13 7/16	12 15/16	— ⅛	3 2 4
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8	8	8	8	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 15 6
2,588,376	Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	85½	85	..	4 12 0
16,000	Cuba Telegraph	10	5 %	5 %	6 %	..	7⅛ — 8⅛	7⅛ — 8⅛	7⅞	7⅞	..	7 1 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16⅜ — 17⅜	16⅜ — 17⅜	..	..	..	5 14 3
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3 — 3½	3 — 3½	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	..	8 — 9	8 — 9	..	..	..	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	8 16 6
80,710	Direct United States Cable	20	4½%	4½%	4½%	4½%	12 — 12⅜	12 — 12⅜	12⅜	..	..	6 16 0
48,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —103	99½ —101½	..	..	— ½	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock.	Stock	7 %	7 %	7 %	..	126 —129	126 —129	127½	126	..	5 8 6
2,000,000	Do. 8½ % Pref. Stock..	100	8½%	8½%	8½%	..	84 — 87	84 — 87	86	85½	..	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103¾ —105½	103¾ —105½	105	104	..	3 17 8
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	..	11⅞ — 12¼	11⅞ — 12¼	12⅛	11⅞	..	5 14 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	99½ —101½ xd	100⅛	100⅛	..	3 18 10
200,000	East & S. Afric. Tel., 4 % Mt. Db. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100½ —102½	..	..	+ ½	3 18 1
181,127	Globe Telegraph and Trust	10	5⅛%	5⅛%	5⅛%	..	10 — 10⅛	10 — 10⅛	10 1/16	10	..	5 14 8
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	..	12⅞ — 13⅛	12⅞ — 13⅛	13⅛	12⅞	..	4 7 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	..	30 — 32	30 — 32	32½	..	..	6 5 0
14,800	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	99½ —101½	..	..	— ½	4 8 8
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	..	52 — 55	52 — 55	52	..	..	6 16 4
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	74 — 78	74 — 78	..	..	..	5 2 7
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	71 — 74	71 — 74	..	..	..	5 12 8
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅛ — ⅜	1/16 — 1/8	15/9	11/8	+ 1/16	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	8/- — 8½	8/- — 8½	18/-	..	..	6 0 9
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	8½ — 8¾	8½ — 8⅝	..	..	..	5 3 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	109 —111	109 —111	110	109	..	5 7 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	122 —124	120½ —122½	123	120⅞	—1½	4 18 0
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½ — 11½	10½ — 11½	..	..	— ½	5 6 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10½ — 11½	10½ — 11½	..	..	..	5 6 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 1/16 — 5 1/8	5 1/16 — 5 1/8	5⅛	5 1/16	+ ⅛	4 5 1
2,000,000	Do. do. 8½ % Deb. Stock Red. ..	Stock	8½%	8½%	8½%	8½%	97 — 99	97 — 99	98½	97½	..	8 10 11
1,716,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99½ —101½	99½ —101½	100⅛	99½	..	3 18 10
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	..	1 1/16 — 1 1/8	1 1/16 — 1 3/16	..	..	+ 1/32	5 16 1
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	..	1⅛ — 1¼	1⅛ — 1¼	..	..	..	4 16 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	88 — 90	88 — 90	..	..	..	4 8 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,889	Reuter's	8	5 %	5 %	5 %	..	7 — 8	7 — 8	..	..	..	5 0 0
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	100½	..	..	4 9 1
3,083	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..	4 12 4
100,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6½ — 7	6⅜ — 7	..	..	..	5 14 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	4⅛ — 5⅜	4⅛ — 5⅜	..	..	..	4 13 0
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	Nil	2½%	2½%	..	1¼ — 1⅜	1¼ — 1⅜	30/-	..	+ ⅛	4 8 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —101	99½ —101½	..	..	+ ½	3 18 10
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	..	12⅜ — 13⅛	12⅜ — 13⅛	13 1/16	12⅛	..	5 5 8
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	101½	..	..	3 17 8
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	7/16 — 9/16	1/16 — 1/8	..	..	+ 1/32	Nil
84,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	7⅜ — 8⅜	7⅜ — 8⅜	..	..	..	7 7 8
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	..	7⅛ — 8½	7⅛ — 8½	..	7½	..	2 14 1
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,007	5	8 %	8 %	9 %	..	8 1/32 — 9 1/32	8 1/32 — 9 1/32	9	8 1/32	..	4 19 2
260,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5⅛%	5⅛%	5⅝%	..	6⅛ — 6⅝	6 — 6½	6⅛	6 1/16	— ⅛	4 12 0
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	137 —142	137 —142	138½	..	..	4 4 6
286,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
580,000	Babcock & Wilcox, 1 to 580,000	1	20 %	30 %	20 %	..	3⅞ — 4	3 15/16 — 4 1/16	80/7½	78/11½	+ 1/16	3 18 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	2 13 10
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	..	1⅞ — 2⅛	1⅞ — 2	..	..	— ⅛	17 10 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	3⅛ — 3⅜	3⅛ — 3⅜	66/3	65/-	..	8 12 5
40,000	Do. do. "A" 6 % Cum. Pref. ..	5	6 %	6 %	6 %	6 %	3½ — 4½	3⅝ — 4½	..	..	..	7 1 2
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3¼ — 4½	3¼ — 4½	..	..	..	4 8 11
800,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96⅜ —100½	96 — 98 xd	..	..	..	5 12 3
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	136 —139	136 —139	..	..	..	5 15 1
400,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	..	117 —121	114 —118	117	..	—3	4 4 9
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	105½ —107½	105 —107	..	..	— ½	4 13 6
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	10 15 6
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	101 —104	103½	102½	..	4 6 7
138,301	British Electric Traction	10	3 %	Nil	Nil	..	1⅝ — 1⅞	1⅝ — 1 15/16	18/9	..	..	Nil
161,457	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	..	3¾ — 4	3¾ — 4	70/-	..	..	7 0 0
1,473,668	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	90 — 95	90 — 95	90	..	..	5 5 3
628,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	73 — 75	73 — 75	..	..	..	6 0 1
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	..	6⅞ — 7	6⅞ — 7⅛	..	..	+ ⅛	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	..	6⅛ — 6⅜	6⅛ — 6⅜	..	..	..	4 12 4
600,000	Do. do. 4½ % 1st Mort. Deb. Red..	100	4½%	4½%	4½%	4½%	103 —106	104 —107	..	..	+1	4 4 1
208,440	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	..	91 — 96	91 — 96	..	..	..	4 13 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	..	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
1,016,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	43 — 48	44 — 49	..	..	+1	8 2 4
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,781	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	..	59 — 64	59 — 64	..	..	..	7 0 8
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	..	38 — 42	38 — 42	..	..	..	10 14 4
137,610	Calcutta Trams, 1 to 137,610	5	8 %	8 %	6 %	..	4¼ — 5	4¼ — 5	..	..	..	6 0 0
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4½ — 5½	4½ — 5½	5⅛	..	..	4 15 3
860,000	Do. do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	9 — 10	9 — 10	..	..	..	7 10 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5½ — 5⅝	5½ — 5⅝	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	106½	..	..	4 3 4
491,222	Cape E Trams., 1 to 491,222	1	Nil	Nil	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	5 %	8 %	12 %	..	1⅛ — 1⅜	1⅛ — 1⅜	82/3	..	..	7 10 4
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	103 —107	101 —105	..	..	—2	4 5 9
1,893,610	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3½%	63 — 65	63 — 65	64½	63½	..	4 13 9
553,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	84 — 86	..	..	..	4 12 0
553,195	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	50 — 52	47 — 49	49	..	—3	5 2 0
1,480,000	City and South London Railway	Stock	1⅞%	2½%	2½%	1½%	28 — 29	27 — 28	28½	27⅝	—1	5 7 2
85,000	Crompton & Co., Nos. 1 to 85,000	B	2½%	5 %	5 %	..	1½ — 1⅝	1½ — 1⅝	82/3	..	..	7 10 0
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	96 — 99	96 — 99	..	..	..	5 1 0

* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	Closing Quotations Jan. 26th.	Closing Quotations Feb. 2nd.	Business done week ended Feb. 2nd, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	1 5/16 — 1 3/8	1 5/16 — 1 3/8	..	..	..	7 12 5
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	1 7/16 — 1 1/2	1 7/16 — 1 1/2	22/3	..	..	5 1 1
276,880	Do. dc. 4½ % Deb. Stock	100	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6 %	6¼ %	11½ — 12½	11½ — 12½	..	..	..	5 4 0
60,000	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 5 9
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½%	4½%	4½%	..	7/16 — 1/2	10/-	..	..	16 15 3
17,189	Do. "A" shares, 01—017,189	5	4½%	4½%	4½%	..	1½ — 2½	..	..	..	8 6 9
317,875	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	75 — 78	75 — 78	75	..	..	5 2 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	..	86 — 89	86 — 89	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	3/8 — 1/2	3/8 — 1/2	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	1½ — 1½	1½ — 1½	..	..	..	9 6 9
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	..	7 — 7⅛	7 — 7⅛	..	..	..	6 13 4
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	85 — 89	85 — 89	..	..	..	4 9 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	Nil	1/4 — 3/8	1/4 — 3/8	..	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	10½ — 10¾	10½ — 10¾	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	..	11½ — 12½	11½ — 12½	11⅞	..	..	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	..	5 — 5½	5 — 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	105½—107½	105½—107½	..	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	..	15½ — 16½	15½ — 16½	15⅝	15½	..	6 1 3
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	..	1/8 — 1/4	1 — 1½	..	..	..	5 6 8
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	..	4 — 4½	4 — 4½	..	..	..	11 2 2
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	..	6¼ — 6⅝	6¼ — 6⅝	..	..	..	4 8 11
399,980	Do. do. 50,008 to 100,000	10	3 %	3 %	..	6¼ — 6⅝	6¼ — 6⅝	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	..	3¾ — 4⅛	4 — 4½	83/9	..	+ ⅛	11 2 2
1,881,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	69 — 73	70 — 74	70	..	+1	5 8 1
5,782,062	Metropolitan Consolidated	100	2½%	1 ½%	½%	36 — 37	36½ — 37½	37⅛	36⅜	..	1 6 8
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	70 — 72	69 — 71	69⅛	..	—1	3 17 6
8,235,000	Do. District	100	Nil	Nil	Nil	13¾ — 14½	14¼ — 14⅝	14 11/16	13⅝	+ ⅛	Nil
814,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	3/8 — 5/8	3/8 — 5/8	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	3/4 — 7/8	3/4 — 7/8	13/11	..	..	5 19 5
823,800	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	93 — 96	92 — 95	..	..	..	4 13 9
$6,000,000	Mexico Trams Co., Common Stock	..	..	..	..	140 —143	141½—143½xd	142⅜	138	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	92 — 93	92 — 95	94⅛	92½	+1	..
245,500	Potteries E. Tro.	1	4 %	4 %	..	1/4 — 3/8	1/4 — 3/8	..	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	..	3/4 — 7/8	3/4 — 7/8	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	90 — 93	90 — 93	..	..	..	4 14 9
27,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	32 — 34	32½ — 34½	33⅜	33¼	+ ½	6 1 8
150,000	Do. 4 % Deb. Bds., 1 to 1.500 Red., 1909	100	4 %	4 %	4 %	99 —102	99½ —101¼	..	..	..	3 18 10
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	98½ — 99½	98½ — 99½	99⅛	98⅞	..	..
2,800,000	Do. do. 4½% Bonds	..	..	..	4½%	82 — 84	81 — 83	81⅜	81½	—1	5 8 5
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	26 — 28	26 — 28	28	26½	..	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	Nil	10 %	3/8 — 7/8	3/8 — 7/8	..	..	..	10 0 0
66,666	Do. 6 % C.P., 80,001 to 80,000 & 126,001 to 141,666	5	Nil	..	6 %	2⅜ — 2¾	2⅜ — 2¾	..	..	..	10 8 8
246,404	Do. 4 % 1st Mort. Deb. Stock		4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 11 1

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	..	5½%	5½%	5½%	4½ — 5	4½ — 5	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	94 — 98	94 — 98	..	..	..	4 10 0
20,275	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	8⅜ — 8⅞	8⅜ — 8⅞	..	..	..	5 12 8
9,725	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	8 — 8½	8 — 8½	..	..	..	4 2 4
395,276	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	98 —101	98 — 101	..	..	..	3 19 8
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	..	4⅜ — 4⅞	4⅜ — 4⅞	90/-	..	..	5 2 7
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	..	4¼ — 4⅝	4¼ — 4⅝	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	..	3⅝ — 4⅛	3⅝ — 4⅛	77/6	..	..	5 5 11
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
49,456	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	..	..	..	5 5 11
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	102 —105	102 —105	104	..	..	4 5 9
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	..	10¾ — 11	10¾ — 11	10⅞	..	..	5 6 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	..	12 — 12⅜	12 — 12⅜	..	..	..	4 14 1
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	121 —122	121 —123	..	..	..	4 1 4
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	..	2¾ — 3	2¾ — 3	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	..	3¼ — 3⅜	3¼ — 3⅜	..	..	..	6 13 4
210,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	96 — 98	96 — 98	..	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	..	8⅜ — 9¼	8⅜ — 9¼	9 1/16	..	..	5 8 1
50,026	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	..	10⅜ — 11¼	10⅜ — 11¼	11⅛	11	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	105 —108	105 —108	101	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	3/8 — 5/8	3/8 — 5/8	..	..	..	Nil
420,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	59 — 62	59 — 62	..	..	..	7 0 8
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	85 — 87	85 — 87	..	..	..	..
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	6⅜ — 6⅝	6⅜ — 6⅝	..	..	..	5 2 0
$1,825,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	96 — 97	96 — 98	97⅛	96⅝	+ ⅛	5 3 1
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	7⅞ — 8¼	7⅞ — 8¼	..	..	..	6 1 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	95 — 98	95 — 98	100⅛	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	1⅜ — 1⅝	1⅜ — 1⅝	28/9	..	..	3 8 8
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	4½ — 5¼	4½ — 5¼	..	..	..	5 14 3
374,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4 %	89 — 93	89 — 93	..	..	..	4 16 9
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6¼%	4⅜ — 5⅛	4⅜ — 5⅛	99/4½	..	..	6 6 10
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½ — 5	4½ — 5	93/9	..	..	4 10 0
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
248,000	Do. 3½ % Mort. Deben. Stock Redeem.	Stock	3½%	3½%	3½%	85 — 88	85 — 88	85½	..	..	3 19 7
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	87 — 88	87 — 88	87⅜	87½	..	5 13 8
13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	85 — 87	83½ — 85½	85⅜	82½	—1½	..
$1,500,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	112½—114½	109 —111	113	110	—3½	..
$12,000,000	Do. do. 5% 1st Mtg.Gold Bnds.	..	..	..	5 %	92½ — 93½	90 — 91	99⅜	90	—2½	5 9 11
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	4⅛ — 4⅜	4 — 4⅛	..	..	— ⅛	5 17 9
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	5	..	..	4 10 11
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	100 —102	100 —102	..	..	..	..
10,859	Notting Hill Electric Lighting	10	7½%	7½%	7½%	11¼ — 11⅞	11¼ — 12¼	..	..	..	6 5 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	5¼ — 6⅛	5⅝ — 6⅜	6¼	6 1/16	..	5 9 10
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	..	1⅝ — 1 13/16	1⅝ — 1 13/16	24/3	23/6	..	..
100,000	Do. do. 6% Non Cum. Pref. Nos.1 to 100,000	1	6	6	6	1 15/16 — 1 15/16	1 15/16 — 1 15/16	20/6	20/3	..	..
194,684	Do. do. 5% Deb. Stk. Red.	100	5	5	..	99 — 102	99 —102	..	..	..	4 18 0
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	8⅝ — 9⅛	8⅝ — 8¾	8⅝	..	— ⅛	5 12 8
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	6¾ — 7¼	6¾ — 7¼	..	..	..	4 16 7
150,000	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	86 — 90	86 — 90	..	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	5/16 — 7/16	5/16 — 7/16	..	..	..	Nil
46,700	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	68 — 72	69 — 70 xd	..	..	..	5 11 1
65,000	South London Electricity Supply, Ord.	4	4 %	3 %	4 %	2¼ — 2⅝	2⅜ — 2⅝	..	..	..	6 10 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	1⅞ — 2	1⅞ — 2	..	..	..	3 6 8
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	1 5/8 — 1 3/4	1 5/8 — 1 3/4	..	..	..	5 16 8
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 6
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	..	⅝ — 1	⅝ — 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	..	1⅝ — 2	1⅝ — 2	..	..	..	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	80 — 83	80 — 83	..	..	..	5 8 5
800,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	13/16 — 15/16	13/16 — 15/16	16/3	16/-	..	..
110,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	8⅜ — 8¾	8⅜ — 8¾	8½	..	— ⅛	5 14 3
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	5⅛ — 5⅜	5⅛ — 5⅜	5 1/16	..	..	4 1 10

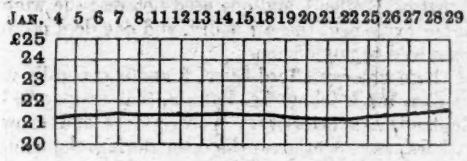
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. § Interim Dividend.

Bank rate of Discount, 3 per cent., January 14th, 1909

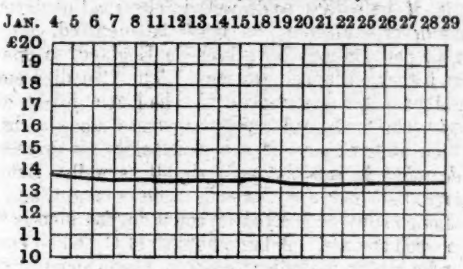
METAL MARKET.

Fluctuations in January.

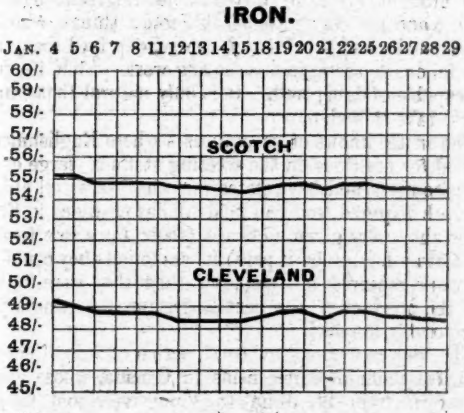
SPELTER (G.O.B's.).



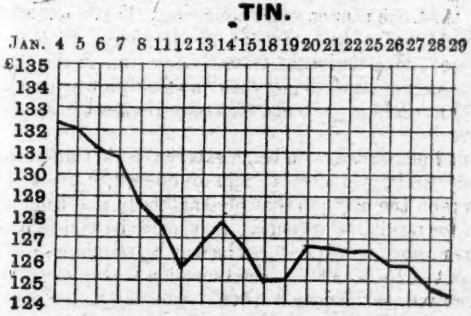
LEAD (ENGLISH).



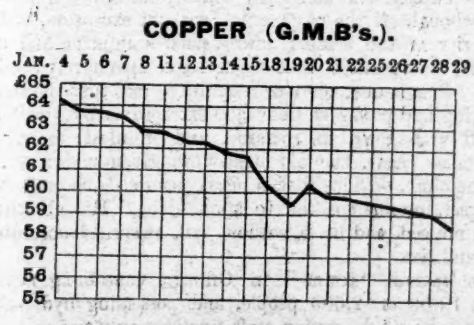
IRON.



TIN.



COPPER (G.M.B's.).



Cape Town Electrical Contractors.—By the last mail from the Cape we learn from our correspondent that the Cape Town Electrical Contractors' Association has been dissolved. Its members have joined the Chamber of Commerce, which now has an electrical engineering section, with eight firms as members at present.

AMERICAN STREET AND ELECTRIC RAILWAYS.

The following is the preliminary report on street and electric railways, prepared by Mr. T. Commerford Martin, of the United States Department of Commerce and Labour, Bureau of the Census:—

January 18th, 1909.

CONTINENTAL UNITED STATES

(*Exclusive of Alaska, Hawaii, Philippine Islands, and Porto Rico*).

The statistics relate to the years ending December 31st, 1907, and June 30th, 1902. The totals include reports of operating and lessor companies, and a considerable number of electric light plants operated in connection with electric railways, but do not include reports of railways under construction during the census years; nor do they include reports of financing companies which were not engaged in actual operation of railways or light plants.

	1907.	1902.	% inc.
Number of operating and lessor companies	1,236	987	25·2
Length of line (first main track), miles	25,547	16,662	53·4
Total length of single track, miles	34,401	22,577	52·4
Number of cars, total	83,641	66,784	25·2
Passenger	70,016	60,290	16·1
All other	13,625	6,494	109·8
Number of power houses	827	805	2·7
Steam and gas engines (inc. turbines), No.	2,552	2,351	8·5
Horse-power	2,384,518	1,300,058	83·4
Water-wheels, number	228	160	42·5
Horse-power	91,961	49,303	86·5
Total kw. capacity of dynamos	1,727,030	898,362	92·2
Output of stations, total kw.-hours	4,759,180,100	2,261,484,397	110·4
Passengers carried, total	9,533,080,786	5,836,615,296	63·3
Fare	7,441,114,508	4,774,211,904	55·9
Transfer	1,995,658,101	1,062,403,392	87·8
Free	96,308,157	*	..
Total car mileage (passenger, exp., freight, &c.)	1,618,343,584	1,144,430,466	41·4
Condensed income account, operating companies:			
Earnings from operation	$418,187,858	$247,553,999	68·9
Income from other sources	† $11,556,396	$2,950,628	291·7
Gross income	$429,744,254	$250,504,627	71·6
Operating expenses	$251,309,252	$142,312,597	76·6
Net earnings (less operating expenses)	$166,878,606	$105,241,402	58·6
Gross income (less operating expenses)	$178,435,002	$108,192,030	64·9
Deductions from income (taxes and fixed charges)	$138,094,716	$77,595,053	78·0
Net income	$40,340,286	$30,596,977	31·8
Dividends (operating companies only)	$25,558,857	$15,882,110	60·9
Surplus	$14,781,429	$14,714,867	0·5
Capitalisation, operating and lessor companies:			
Capital stock authorised, par value	$2,508,054,336	$1,529,199,589	64·0
Capital stock outstanding, par value	$2,097,708,856	$1,315,572,960	59·5
Dividends on stock	$58,589,399	$33,089,171	62·2
Bonds authorised, par value	$2,319,290,837	$1,341,429,727	72·9
Bonds outstanding, par value	$1,677,063,240	$992,709,189	68·9
Interest on bonds	$71,468,588	$43,578,961	64·0
Total par value stock and bonds outstanding ‡	$3,774,772,096	$2,308,282,099	63·5
Employés and wages, operating companies:			
Salaried employés, number	11,709	7,128	64·1
Salaries	$12,909,466	$7,439,716	73·5
Wage-earners, average number	309,729	193,641	59·9
Wages	$138,081,633	$80,770,449	71·0

* Not reported separately.

† Includes $3,255,618 income from interest on bonds and dividends on stock of other electric railways.

‡ Includes permanent and other investments, such as securities of other electric railways, treasury stocks and bonds, gas plants, &c.:—1907, $388,394,092; 1902, $152,513,997.

The final report for 1907 (now in course of preparation) will contain an analysis of the above totals, and present detail statistics for other phases of the industry. The telephone and telegraph return is expected to be ready in a few days.

Annual Gathering.—The "Z" Electric Lamp Manufacturing Co., Ltd., gave their first annual tea and entertainment to their employés on Monday, 25th ult., at the Lawrence Hall, Southfields, where their lamp factory is situated. As their filament works are at Willesden, it was arranged for a special excursion for the purpose of enabling all to meet for this social event. The chair was taken by Mr. J. G. B. Stone. During the evening a souvenir was presented by Mrs. Stone to each of the employés, who numbered over 200, and Mr. M. A. Simson made a speech, in which he said that the directors were more than satisfied with the progress made in the manufacture of the "Z" metallic-filament lamps. It is proposed to make the event an annual one, also to arrange a scheme whereby the employés may participate in the profits. Mr. Stone expressed thanks to the general manager, Mr. Packenham, for the able manner in which he had conducted the business.

Patent Restorations.—According to notices appearing in the *London Gazette* of January 29th, the Comptroller-General of Patents has made orders restoring a number of letters patent granted to Henry Colbeck Michell for "Improvements in non-conducting coverings for pipes, boilers and other purposes," "Improvements in the manufacture of flaky mica for boiler coverings," &c.

CANADA—AN IMPRESSION.

By R. TURNBULL MAWDESLEY.

According to all guide books, and to the information on Canadian matters in general—and electrical engineering matters in particular—which can be obtained from the numerous shipping and emigration agents, it seems only necessary for a Britisher to purchase his passage; to land in Montreal, or one or other of the great centres of industry; and to commence work almost immediately. Then, in the course of a few years, he returns to the "Old Country" with enough of this world's goods (saved from the princely salaries which are offered to men experienced in electrical matters) to keep him in affluence for the rest of his days.

Perhaps one engineer out of a hundred will have had a successful career in Canada, and from him you may receive confirmation of the eulogies of the country as doled out by the various agents—but from the ninety and nine who have become lost among the thousands of unemployed Britishers in Canada (chiefly Englishmen), you may hear nothing whatever; for a British engineer is very reticent about his failures in life, and, in most cases, prefers to keep quiet and not allow his friends to know how low he may have sunk. It is truly surprising how very many experienced men (the writer is speaking of men experienced in electrical work, not, perhaps, what are termed generally "electrical engineers," but rather "electricians," wiremen and winders) have been out of employment during the past 12 or 18 months.

There is absolutely no doubt whatever that the recent financial crisis in the United States affected Canada and her industries in a very marked degree; and this caused unemployment, not only in engineering centres, but everywhere, the larger employers of labour finding it necessary to reduce their staffs; even farm labourers, for whom generally there is always a big demand, experienced difficulty in getting jobs.

It should be explained that Eastern Canada is in the grip of winter (with a capital "W") from about the beginning of December until the end of April, and during this period is experienced very severe weather, totally unknown to and unrealised by "Old Country" people. Snow begins to fall towards the end of November, and the land is covered, without break, until the end of April. It is not the sort of snow known here, *i.e.*, snow which becomes "slush" the following day. It comes to stay, and one sees no "wheeled" vehicles about the streets and country roads in winter. Sleighs are invariably used by the farmer, and even the cabs in the cities are upon "runners."

The temperature does not generally rise above freezing point after December 1st, and it is obvious that unemployment during the winter months—when, even in the most prosperous periods, work slackens off a little—is a very serious thing indeed. It should be added, however, that the Canadian winter is not at all bad for English or any other people who are in employment, and can afford the necessary clothing and the wherewithal to keep alive. The air, though sometimes extremely cold, is dry and bracing, and the writer has felt no ill effects from being out in the open with the thermometer showing a temperature of 30° below zero.

One would not unnaturally imagine that, in a temperature like this, all outside work, such as structural work, carpentering and bricklaying, would be impossible, but it is not so. The writer has seen bricklayers at work with their beards and moustaches frozen solid (unknown to themselves). It was, of course, necessary to use *boiling* water for the mortar, as cold water would have become ice before the bricks could have been placed. It is extremely curious that in such a low temperature, one's eyebrows and eyelashes become frozen without one's own knowledge and without inconvenience to oneself; and in one instance, the writer saw a man working on the top of a pole (one of a 50,000-volt pole line) with his moustache frozen to the insulator, and he had to thaw it with a "blow torch" before he could descend.

Towards the end of May, better weather may be expected, and in the summer months, *i.e.*, from June to September, more beautiful weather could not be imagined. When summer comes, it also *comes to stay*, and it does not rain one day and snow the next. There is an uninterrupted spell of fine and bright weather, with rain at rare intervals, and then mostly during the night.

Taken on the whole, the climate of Canada is much better than that of England, and one need not fear the winter, for, as before explained, the air is dry, and one does not feel the extreme cold to any degree.

By those who can afford them, furs are generally worn in the winter, but thick under-clothing, such as may be bought in England, is a necessity. Warm gloves and snow boots (overshoes) are essential in the open during the winter, and the lightest of light clothing in the summer.

If an experienced man wishes to "make good" in Canada, that is, if he wishes to do well in electrical engineering or in any other profession, he must be prepared, no matter what his position may have been in England, to don overalls and work with the next man. The Canadian employer generally needs no references. If he has a job to offer he will give the first good man who comes along a chance to show his ability; and if the man fulfils his promises, and *can do what he said he could do*, all is well. But if the employer finds out that his man made pretences, and cannot do what possibly he boasted he could do, the man is "fired" (dismissed) at once. A large number of Canadian employers are undoubtedly prejudiced against Englishmen. This has been brought about by disreputable Englishmen going to Canada and professing to be able to do things which they could not do, and this has, of course, deprived many a good man following them from securing work which he perhaps was capable of doing well. It is only natural that employers should take this view.

The writer knows of several cases where Englishmen have applied for positions on the erecting staffs of large electrical manufacturers, and have stated that they were well able to do the work required, and had held similar positions in England. When they were given a chance (their fares to a town some miles away having been paid) it was found they could not do the work required of them, and thus they were "fired"—and the prospect of the next Englishman getting a job was considerably lessened.

The superintendent of construction of one of the largest electrical manufacturing firms in Canada, whose apparatus is known from St. John to Vancouver, told the writer definitely that he would not engage another Englishman at all! And one cannot well blame him. While on this point, it might be as well, perhaps, to mention that there have appeared advertisements from time to time in the Canadian papers stating *emphatically* that "no Englishmen need apply," but the writer only saw one such advertisement in an electrical paper.

But the average man, be he experienced in station work, or factory work, is almost certain to do well, if he is prepared to take on the first job that presents itself, and keep his eyes open for a suitable vacancy. It should be said at once that no man, however experienced he may be, should go to Canada without £25 or £30. The Canadian Government make it imperative that incomers should possess at least $25 (£5), but to an electrical man this, in many cases, is not enough.

Although all the large cities, without exception, and the majority of the smaller towns, possess lighting and power plants, the vacancies that occur are, comparatively speaking, few. This is due, more or less, to the fact that the staffs of lighting and power stations are extraordinarily small, compared with some in Britain; and in most cases, when vacancies occur, the old hands are given preference. It is, therefore, obvious that a newcomer must be prepared to accept a humble position to start with. His abilities are soon noticed, and he is, without fail, rewarded according to his abilities.

In several "towns" in Ontario, containing not more than 1,800 or 2,000 people, and possessing hydro-electric plants, the whole station staff numbers only two men. The "chief" does the "day" shift, and where the plant can conveniently be shut down during the day, he looks after all the pole lines (very few underground cables are used in the smaller towns, the transmission being carried out by bare overhead conductors at 2,200 volts pressure, and transformers being placed on poles wherever one is needed), donning

climbing-irons, making all necessary connections, &c., and being directly responsible to the municipal council for the upkeep and operation of the plant. The "night" shift is, of course, undertaken by a junior (sometimes a junior in position only, not in age).

In most of the power stations visited by the writer, the machines were of ample capacity; and, with few exceptions, whether the plants were large or small, overloading of machines was practically unknown.

Apart from the mammoth plants on the Niagara river, the largest transmission plant in Eastern Canada is that of the Shawinigan Water and Power Co. at Shawinigan Falls, Quebec Province (described in these columns March 23rd, 1906), though the Montreal Light, Heat and Power Co. owns plants which, in the aggregate, possibly total more horse-power. The Montreal Street Railway Co. takes power from the M.L.H. & P. Co. for traction purposes, some of which comes from Shawinigan *via* the Montreal L.H. & P. Co. (In the charter granted to the Shawinigan Co. it was expressly stated that it should supply only the M.L.H. & P. Co. in the Montreal district with power "in bulk.")

The City of Quebec is supplied with power for its electric lighting and traction from a plant situated at Montmorency Falls, about 20 miles below Quebec.

The City of Toronto takes its supply, both for lighting, power and traction purposes, from the Niagara Falls plant of the Electrical Development Co., of Ontario, one of the numerous Mackenzie-Maun interests, the power being transmitted on 60,000-volt lines to a terminal station in the outskirts of the city.

The Toronto Railway Co. (another of the Mackenzie-Maun Companies) originally had a steam plant of its own, but this has since been discarded, and the company possesses motor-generator sub-stations in different parts of Toronto, the old steam plant at present lying idle, though it is understood it could be started up again almost immediately in case of a lengthy "shut down" at Niagara.

The plants on the Niagara River have already been described in these columns, as have also the Kaministicka Power Co.'s plant at Kakabequa Falls, and the West Kootenay plant.

The above-mentioned plants are all hydro-electric, which will give some faint idea of the enormous water power available in Canada, three-quarters of which, it is estimated, has not been developed.

The principal manufacturing companies are as follows:—

The Canadian Westinghouse Co., Hamilton, which supplies all types of "Westinghouse" apparatus, including its famous brakes.

The Canadian General Electric Co., Peterboro', which has just completed most sumptuous and capacious head offices on King Street, Toronto.

The Allis-Chalmers-Bullock Co., Montreal, and the Packard Electric Co., St. Catherine's, Ont.

All these companies own most up-to-date factories, and have Sales Offices in all the large cities, but so far as the writer has ascertained, the positions of responsibility in each company are held by Canadians or Americans. One point in connection with these companies is that they "stock" standard types of motors, transformers, &c., up to 50 or 100 H.P., and make delivery of material much more quickly than English companies.

The Canadian Westinghouse Co. and the Canadian General Electric Co. supply most of the apparatus of large capacity, though Allis-Chalmers-Bullock, Ltd., are not far behind in point of popularity. It was this company which supplied the 8,000-H.P. motor (supposed to be the largest motor ever manufactured) to the Shawinigan Co. for their Montreal terminal station.

Electrical apparatus of English manufacture is not much in evidence, and, excepting a 3,000-KW. A.C. generator at Shawinigan, supplied by the English Electric Co. (Dick, Kerr), the writer saw no English-made plant of any size.

The great railway companies have not as yet gone in much for electrifying their lines, although the C.P.R. Co. are to electrify a portion of their line in the Rocky Mountains and the St. Clair Tunnel is now operated electrically. It should be explained that all the cities possess "street railways," *i.e.*, electric tramways, but these should not be confounded with the "rail roads," which are not yet electrified.

To the student and apprentice, Canada is well equipped with technical institutions, such colleges as "McGill" and "Laval" in Montreal, being universally known, and the larger manufacturing companies arrange for the reception of apprentices at a nominal wage, without premium.

The average rate of pay to a "wireman" is, in Quebec and Montreal, 22½ cents to 25 cents per hour (11d. to 1s.); and further West, in Toronto and Winnipeg, as much as 32½ cents to 35 cents (1s. 4d. to 1s. 5d.) per hour is paid to good men. Speaking generally, wiring is more or less carried out as in Britain, but the newcomer must be prepared to adapt himself to slightly different methods: keep his eyes open, and not "swank" too much as to how things are done in Great Britain. Incidentally, it may be mentioned that a good deal of "exposed" wiring is installed in the less important houses and offices, &c., the wires being carried on insulators on the walls and ceilings.

First-class armature winders are well paid, 30 cents per hour being the standard rate, but they must be really good men, accustomed to A.C. and D.C. work.

In power stations "operators," *i.e.*, switchboard attendants, are not often paid less than $50 per month (£10), and "chief operators," *i.e.*, charge engineers, not less than $75 to $83 per month (£15 to £16).

Living is, of course, dearer than in Britain, but good food and accommodation can be had for $5 to $6 (20s. to 24s.) per week, and if a man is not too fastidious, he can get accommodation for even $4. There is not much difference between the country and the town in the cost of living. Clothes cost considerably more than in England, $25 (£5) being quite an ordinary price for a suit, and the smaller necessities of life, such as stationery, hosiery, footgear, &c., are slightly higher in price, and everything that can be bought in England for 1d., costs 5 cents (2½d.).

Finally, if a Britisher wants to succeed, let him go out prepared to do "rough graft" for a time, let him adapt himself to conditions; and above all, let him keep quiet about "the way we do it in England," and eventually he *must* succeed.

Canada is in every respect like other countries so far as "wasters" are concerned. No waster can succeed, be he engineer or farmer; and Canadians are very "sore" about the large number of English wasters (mostly Londoners) who manage somehow to reach Canada, and who do not want work, and are no good to either man or beast. *Grumblers* are certainly not required. It is found that foreigners (Scandinavians, Germans and Italians) are prepared to take anything offered, and in this way they generally come out ahead of the dilatory Englishman.

The *Times* special correspondent, who has recently toured Canada, quotes the proprietor of the Toronto *Evening Telegram* as stating:—"The Englishman who succeeds in Canada is hardly ever a Londoner. The Englishman who fails completely is almost always a Londoner."

The writer can confirm this statement, as he has spoken to large numbers of the men who daily congregated outside the offices of the above paper in Toronto (as explained by the *Times'* correspondent), and 90 per cent. of the men who were looking for jobs as electricians, wiremen and fitters, were indubitably Londoners, whose very appearance betokened laziness and thriftlessness: and out of the few Englishmen holding exalted positions in the Canadian electrical world, the writer never met one who was a Londoner. They may have gained some of their experience in the great London power stations, or at Finsbury, but in no case (and the writer, perforce, met numbers of these men) did they claim London as their native place.

Memorial to Mascart.—We have received from the President of the Société Internationale des Electriciens, M. P. Boucherot, a letter regarding the monument which it is proposed to raise in memory of M. E. Mascart, the distinguished physicist, and we have much pleasure in commending this project to the notice of our readers. We understand that an artistic souvenir of the monument will be sent to each subscriber. The list of subscriptions will be closed on March 1st. Up to the 25th ult. a total of 6,116 fr. had been received.

THE PERSONAL FACTOR.

By VILEX.

Your Editorial of November 27th, and Mr. Mordey's address to the Institution, raise a serious question. Mr. Mordey asserts that :—"We are ahead, and well ahead." You suggest that there may be something rotten in the state of the electrical industry. Accepting his proofs, and assuming that Mr. Mordey is right, we would expect the commercial, and financial side of the business to be also ahead. This, unfortunately, is not the case, and the object of this article is to point out one of the reasons, as we can expect no remedy until the causes of the trouble are discovered.

Even in the present state of bad trade, and keen competition, considering the increasing demand for electricity for all purposes, we should expect that a fair trading profit could be obtained. That this is not so is plainly evident, and the usual reason given is that we are suffering from over-production. Now, it is noticeable that a large quantity of electrical material is still imported from abroad, and that the companies which suffer the most are the large ones. These two facts have led the writer to consider if some other, and more subtle reasons may not be the cause of the trouble, and he would point to one, which, for lack of a better definition, might be called "Neglect of the Personal Factor."

The large companies, and we are now discussing only the few large manufacturing firms which dominate the trade, certainly seem, to a casual observer, to have reduced organisation to an exact science. They consist of many departments. For instance there are works, head office, and sales departments, and these again are divided into many other smaller departments. Over all these presides one man—the managing director. He requires to be an organising genius. His business, like that of the general of an army, is to plan, direct, and control, to select the best men and materials for his ultimate object, to keep them working in the highest state of efficiency, and to leave the details to his subordinates. Even in this early stage of the discussion, we are met by the first difficulty. What is the ultimate object of business? Now the essence of all business may be defined as making the largest turnover, with the largest percentage of net profits, consistent with the reputation of the firm. Everything that tends toward this end is good business, and everything which interferes with it should, if possible, be immediately altered. Accepting orders at cost price, or under, may sometimes be necessary, but it has a bad effect on shops, and sales departments, and creates a false feeling of prosperity which can only have one end.

An organisation can easily be compared to an engine, and a managing director to an engineer. Each part, or department, requires to be properly designed, not too weak, or too strong, each part in the right place, every motion harmonious, so that the whole may work easily and efficiently. The managing director should look after that, seeing that the machine is kept working efficiently, and repaired when necessary. It is evident that one man cannot personally attend to everything, consequently much must be left to those under him, and only by careful selection of the right men as heads of departments, can the best results be obtained. This is where the personal factor comes in.

In every large business three classes of men are required: the administrative, the commercial, and the constructive. These three types are generally distinct; in fact, the few men who combine all three qualifications may generally be found in business for themselves. Yet how often do we find a company trying to interchange the positions. Because an engineer does well at the works, he is transferred to head office; or a head office man is made a branch manager—the result being a square peg in a round hole, and inefficiency. If we consider the large manufacturing companies, we find that a great many good positions are held by foreigners, mostly Germans and Americans. This seems a doubtful policy. A foreigner may be a very good man, but he is generally out of touch with local conditions, and out of sympathy with his own employés and customers. Take a simple instance. One of the large manufacturers started a wiring business, using each branch as a centre. This attempt, which ended in failure, was doubtless a great expense, and lost them a lot of their customers, thus showing a complete ignorance of local conditions on the part of the managing director. It appears to the writer, after many years' experience, that customers prefer to meet Englishmen representing English firms, and that better results can be obtained from English workmen by English engineers. That a sufficient supply can be easily obtained is self-evident, and to meet a possible reply to this argument, the writer may here state that he is not an Englishman. Let us briefly review the chief shortcomings that are most often observed in large companies. Of course, in a short article, it is only possible to touch on a few, leaving the reader to extend these from his own experience.

Consider the publicity department first. The ground work of such a department should be a well-constructed mailing list, kept well up to date. A good mailing list gets in inquiries, keeps customers in touch, and saves travelling time. But a good mailing list is extremely rare. Again, literature has to be published, and this means an expensive department. Why, when the expense has been undertaken, spoil the whole thing by small economies, such as low salaries, cheap literature, and poor indexes? At present there are few complete, well-published, and properly indexed catalogues. Their place is taken by a heterogeneous mass of price sheets, catalogue sections, leaflets, illustrations, circular letters, fly-sheets of discounts, and patent binders, which receive their fitting end in the waste-paper basket. Every communication issued by a publicity department is a theoretical commercial traveller, and as such it should be carefully attended to, instead of being done in an aimless manner merely to keep the firm's name before the recipient.

Every company which maintains branches keeps a sales department at the head office. The theory is that this department looks after the interests of the various branches, and assists in their dealings with works. The practice is very different. It is plain that the head of such a department, whose business it is to manage and direct a number of skilled salesmen, requires to be a skilled salesman himself, and a diplomatist and organiser as well. He has often none of these qualities. It is impossible to under-estimate the immense advantage a good sales department is to branches, but as a rule, friction exists at this most salient point. There is a popular saying amongst managers that :—"The sales department is the home of fat salaries, and soft jobs." The general method is for the sales manager to tour about at first-class expenses, from branch to branch, dictating a hard and fast policy regardless of local conditions and opinions. The branch manager's troubles, through local conditions, competition, and insufficient staff, are further increased by demands for long reports on various jobs, lists of sales of certain lines, and a cast-iron, but generally cumbersome, office system. One branch, in particular, can be quoted as an example. Office routine required a head clerk, two typists, two office boys, and half the time of the manager, though only two travellers were kept. One traveller had to supply four copies of his reports. Sales departments argue against this that it is impossible to get suitable men who can be left to themselves by the central organisation. The reason is that good salaries are not paid, and even if good men are obtained, they are not allowed to exercise their initiative powers under the present conditions. There is another evil which results from this system. Most jobs are too closely canvassed, and there is too much sitting on door-steps. The result is, that when the successful firm get the order, they find that they have little profit, and all their competitors a dead loss. If the time wasted in over-canvassing were utilised to look for fresh customers, firms would obtain many orders of which now, they never even hear.

In some companies a yearly conference of branch managers is held, but this is generally a farce, and consists in big officials lecturing the managers, instead of giving them opportunities of explaining their difficulties to each other and to the head office, with a view to their removal. A cheaper and more efficient way would be to publish an official sales organ, in which all the travellers, who after all are the real backbone of the company, could get into touch

with each other. To pass an idea, or even a suggestion on, is to multiply its power. If one traveller has found a way of increasing his turnover, even by £1 a week, and the firm employ 30 travellers, it means, if they all hear of it, a gain of £1,500 per annum to the firm.

That brings up another point—the suggestion box, a success in America, but generally a failure in English works. The reason is simple. The suggestions put in are generally sent to an official who scoffs at them if bad, and declines them if good; but later produces them in a modified form as his own. Who will bother himself making suggestions for which he never gets the credit? Some of the large firms still make all their officials, and even salesmen, sign an agreement by which all patents they take out are the property of the company. This is not legal, but what servant would go to law with his company? What is the result? There is no account headed "Ability paid for, but not used," but there are thousands of items that should be entered under this head.

Works, designing, and estimating departments are a large subject, and would require almost a separate article. Why, when everyone complains of bad trade, are most deliveries bad, quotations generally late, and designs, as a rule, different to what are asked for? The reason deliveries are bad is usually one of two things. Either the firm imagine they are building for stock, when they are really doing an order trade; or they are accepting orders for specials, and trying to deal with them with stock organisation. Anyway, it ought to be as unsavory to have a worthless promise as to have a worthless credit. An English business magnate has laid down a rule that "There is always room for the man who can be relied on to deliver the goods when he said he would." It would be futile to give examples of bad delivery, and it is common knowledge that works and designing department are generally at war. The writer a short time ago sent out an inquiry for a standard 4-H.P. motor to three firms. The time taken by each for quoting was; one day, four days, and eight days. He also sent an inquiry for an ordinary country house steam lighting set, with full standard details, and the time taken in quoting was one day, eight days, and no answer whatever. These three were large electrical firms. Comment seems needless.

Sufficient has now been said, we believe, to prove that in most cases large manufactuerrs suffer from want of co-ordination, and that this is to a great extent due to the neglect of the personal factor. How far this reflects on the financial state of a firm is largely a matter of opinion.

That bad trade cannot be altogether to blame for present bad results is a growing conviction. The C.M.A. shows large increases, and if the cable business is good, surely the electrical industry must also be busy. Against this can be urged that the C.M.A. is a combine. Admitting this, if we cannot have combination, why not try reorganisation? To the writer it seems that what is lacking is a general plan of campaign. A system of organisation may be mechanically perfect, and commercially useless, for nothing in this world can be effective which ignores its personal relationship to its surroundings. Whiteley's, Harrod's, Gamage's, and all the other great commercial successes of the present day were not the outcome of opportunity, but the creation of good trading. Built up by hard work, coupled with personality and good organisation, they were merely the result of a good head, who placed the right men in the right positions. If their original creators had to conduct their present business on the same lines as the electrical companies, it seems probable that their results would be equally unfortunate.

To be successful in business, war, or sport, one must know its science, follow the rules, train carefully, and keep in training. When we consider the question from this point of view it seems that we do not play the game. Indeed, the more we examine business methods in other countries, the more absurd it becomes to state that "We are ahead, and well ahead." Instead, we come back to the old cry, "Wake up, England!"

Bidston Lighting.—Birkenhead T.C. has informed the Wirral R.D.C. that it intends to extend the E.L. mains to the township of Bidston.

EXPLOSION IN A SUCTION-GAS PLANT.

Explosions have been so unusual in connection with suction-gas installations, that the following account of one which occurred recently in Berlin may be of interest. The plant had been in use for about a year, and had worked quite smoothly up to the time of the accident. The gas generator was intended to work three engines of 30, 30 and 50 H.P. respectively. The three engines were directly connected through small gas chambers of about 1 cubic metre capacity with the main gas chamber, which was 1·3 m. high, and 1·28 m. in diameter. This last, in which the explosion occurred, was of 4 mm. sheet, with a single row of rivets. It was stiffened inside by three angle iron rings, which also served to support the sieves. One angle iron ring acted as a flange for the cover—the latter being of 4 mm. sheet held by 44 ⅜-in. screws to the flange. The vessel, as used, contained neither sieves nor coke filling.

The explosion occurred about five minutes after starting the 50-H.P. engine, and a subsequent inspection showed that the 44 screws had given way—some being torn in two, and others having stripped their threads. A calculation showed that the minimum pressure required for this effect would be about 12 atmospheres, and as a U-iron fixed over the cover was thrown off with such force that it passed right over five 2 to 4-storied houses, it seems probable that the actual pressure inside the vessel must have been more like 25 or 30 atmospheres.

This high pressure is confirmed by the fact that the foundations were also displaced. The mixture in the chamber and the pipes leading to it must, therefore, have had practically the most explosive proportions of gas and air possible, and as the normal mixture is in the ratio of 1 : 4 or 1 : 6, a large additional quantity of air must have got into the chamber by some means. This addition may best be explained by one or more of the following considerations:—

1. A few days before the accident the exhausting valve had become jammed from some unknown cause, and, after breaking the handwheel in attempting to open it, the attendant had to leave the valve closed, and start the engines without its use. Before starting up, the usual ventilating process of drawing air and steam through the imperfectly lighted coal was gone through until the gas drawn off at the test-cock at the engine was of satisfactory quality. In this particular case a specially good fire should have been made, and the preliminary suction continued longer than usual. This may not have been done, and consequently the chamber may have been more or less full of air when the engine started with the first active gas from the generator. The engine was always started electrically, then lighting gas was supplied for a short time and, finally, this was cut off, and the engine drew in its own supply from the generator.

2. As stated above, the three engines are all supplied directly from the main chamber without the insertion of separate cocks or valves. This is an obvious mistake in design, as in case one of the engines happens to stop with the inlet valve open, another engine will be able to suck air into the common pipes.

Instructions had been given that all engines should be stopped in such a position that the inlet valves were closed, but it was not possible to decide whether these instructions had been carried out in this case.

3. An examination of the inside of the cover showed a radial marking with rust, which pointed to air leaking in at certain points round the edge cover. The amount of this leakage was estimated at about ·3 litre per second. The period just before the accident was a cold one, with the temperature at night almost under 0° C. The gas entering the chamber at the top from the scrubber, on the other hand, had a temperature of 15° to 20° C. The air would, therefore, naturally flow along the cold walls of the chamber to the bottom, and only a small proportion of it would diffuse into the gas. The small quantities of air would gradually collect until the chamber was full. In this way the explosive mixture may have been present for some time, remaining harmless until ignited by some means.

Probably all three causes were present, and the precautions to be taken would, therefore, seem to be (*a*) to provide cut-out valves in the various pipes, (*b*) the exhausting valve should be kept in working order, and (*c*) a sieve should be inserted in order to prevent back-firing into the gas chamber. Further, the covers of these chambers and of the scrubbers should have solid cast-iron flange seatings provided with reliable packing in turned slots, and the cover itself, which is subjected to heavy forces, should be so stiff that it cannot be set in vibration by the reciprocating action of the engine.—*E.T.Z.*

Production and Use of Copper.—In a U.S. Geological Survey Report by Mr. L. C. Graton, just issued, the world's production of smelter copper in 1907 is set down as 1,589,809,300 lb., of which the United States contributed over one-half, or 868,996,500 lb. Of this American product, 592,326,608 lb. was electrolytically refined, or about two-thirds; Lake copper being 178,534,141 lb. and casting 13,410,678 lb. The direct use by the electrical industries is the largest domestic factor in consumption, being given as 220,000,000 lb., the other items being: Brass manufacture, 150,000,000 lb.; copper sheets, 30,000,000 lb. and castings, 85,000,000 lb. The above figures do not show, however, the full importance and extent of the electrical refining. Foreign copper to the amount of 245,000,000 lb. was also electrolytically treated here, and, in fact, the enormous total of 845,706,283 lb. was electrical. In addition, the refineries turned out approximately 8,466,630 in the form of bluestone.—*Electrical World.*

PROCEEDINGS OF INSTITUTIONS.

Institution of Electrical Engineers (Birmingham Section).

On January 13th Dr. M. Kloss read his paper on "Practical Considerations in the Selection of Turbo-Alternators" (see abstract in the Electrical Review, November 20th, 1908, page 906).

In the discussion, Mr. A. R. Everest (The British Thomson-Houston Co., Ltd.) suggested that as regards the allowance of air for cooling, it was sufficiently accurate to allow 100 cb. ft. per minute for each kilowatt of losses, the heat taken up then increasing the temperature of the air 20° C. If the heated air was not readily dissipated it became necessary to supply a larger amount of air, with corresponding reduction in temperature rise, in order to avoid overheating the machine room. On this account it was desirable with large machines to take the hot air away from the machines by pipes delivering out of doors. Regarding the question of regulation and its influence on the available output from a machine of a given size, he fully endorsed the statements of Dr. Kloss. In high-speed machines with few poles the limit of output was undoubtedly set by the rotor. Having decided on the speed and number of poles, the general construction to be employed and the permissible diameter as limited by considerations of mechanical stresses, the relative distribution of iron and copper was arranged to give as much flux as possible per unit of surface with the proper degree of saturation, and at the same time as high a number of ampere-turns per pole as possible within the permissible limit of heating. A rotor so constructed was at the highest attainable efficiency, and the output to be obtained from the stator depended entirely on the armature reaction permissible as a fraction of the field ampere-turns already determined. If very close inherent regulation was demanded, this fraction must be a small one, while if moderately close regulation was acceptable, the armature reaction might be increased accordingly; thus the ampere-turns, *i.e.*, total volt-amperes output from the stator, were higher in the latter case. Another objection to a specification requiring close inherent regulation, was that in a machine made to comply with such requirements, the mechanical stresses on the windings which occurred at the moment of a sudden short circuit became enormous. He referred to oscillograms taken on a large alternator when intentionally short-circuited, and while in this case the design was such that the steady short-circuit current did not exceed twice full-load current, the oscillograms showed at the instant of short circuit, a current rush to about 17 times full-load value. After about five cycles, the current was still eight times the full-load value. These tests were made on a machine with solid poles. With the usual laminated construction of turbo-alternator poles, the short-circuit current should die down to its steady value more quickly; but even in that case the shocks arising from a sudden short circuit were quite considerable, and were much more serious in the case of a machine having low internal impedance, *i.e.*, one designed for a very close regulation. He was unable to see any advantage in imposing such a requirement. In cases where it was desirable to maintain close regulation in operation, this could be obtained in a perfectly satisfactory way by the use of the Tirrill regulator, which automatically adjusted the exciter to maintain the voltage desired at all conditions of load. The practicability of this method was proved by the fact that about 100 of these regulators were in daily service in the United Kingdom on all classes of machines, and maintaining, as shown by the voltage charts, steadiness of voltage otherwise quite unattainable, even by the closest hand regulation. Employing in this way, automatic control directly upon the exciter, a specification requiring regulation within 1 per cent. at all loads and power factors within the rating could be readily met, without imposing any restrictions which hampered the efficiency of the alternator design in other respects. Lastly, he wished to emphasise the importance of the point, that when making regulation tests on a machine with a load of supposedly unity power factor, an error of only 1 per cent. in the power factor, such as might be caused by the presence of a small amount of reactance in the system, might cause the observed regulation to appear as much as 2 per cent. worse than its true value.

Mr. A. M. Taylor (Birmingham) said that in a recent specification the regulation was determined not by the difference of voltage, but by the difference of the excitation. He noticed that Dr. Kloss spoke of the inherent voltage regulation as being gauged by the voltage rise on removal of the load, and he asked if it would not be preferable to consider the regulation from the point of view of the voltage drop between no load and full load.

Dr. D. K. Morris (Coventry) said he would like to put forward a new method of regulation. It consisted in placing across each phase of the alternator a choking coil of the type described in a recent paper by Mr. Morcom and himself. Such coils differed entirely from ordinary choking coils, in that, owing to their closed magnetic circuit and high saturation, a very small change in impressed voltage caused a very large change in the magnetising current taken from the alternator. The choking coils should be wound so that at, say, 15 per cent. excess voltage, they would take their full idle current of, say, 30 per cent. of the alternator's full current. Thus, at ordinary full load running with normal voltage they would take very little idle current indeed; which current, being in quadrature to the load currents, would not appreciably add to the copper losses in the stator, even when the main load had as low a power factor as ·8. But if the load were suddenly switched off the voltage rise would be slight, for the least rise in voltage would immediately cause the choking coils to take a large idle current which would neutralise the excess field of the generator. Thus the regulation of the generator was greatly improved by the simple device of shunting its terminals with a suitable set of choking coils of the type described. At or near full load, the efficiency was hardly reduced at all by the device, but on light loads the efficiency would be less both on account of copper losses in the stator and in the exciting system. Such coils could be placed, if desired, on the L.T. side of the main transformers or at the distant end of a feeder. Taking the example quoted by Dr. Kloss of a 1,000-kw. alternator costing £1,000 and giving a voltage rise of 17 per cent., for which he estimated an increased cost of £130, in order to reduce the voltage rise to 14 per cent. Such coils would not cost more than £70 at the outside, as against £130, and the apparatus was perfectly self-regulating and had no moving parts whatever. It was possible not only to improve the regulation of alternators by this means, but even to obtain a flat characteristic by making the load current itself keep down the terminal volts of the choking coil, so that when the load was removed, the voltage rise was entirely checked.

Dr. J. D. Coales (Birmingham) asked if it would not be possible to design the machines with a stationary field and a rotary armature.

Dr. Kloss, replying to the discussion, said that in high speed machines it was not advisable to design for very close regulation, because there would then not be so high a short-circuit current. There were two reasons why it was preferable to specify the voltage rise on switching-off the load, rather than the drop on throwing-on the load. First, the drop was bound to be greater than the rise, and for this reason designers did not care to give the drop. Again, it was not likely that a load would come on so quickly as to give no time for the attendant to raise the excitation in a suitable manner, whereas it was always possible that the full load might get thrown off without warning. Very fair regulation could be obtained by using the Tirrill regulator, but if it failed to act properly a very great drop might take place and cause trouble. In order to get not too great a drop in voltage, he found that for practical use it was well to work with a ratio of short-circuit current to full output ranging from 1·5 to 1·6. Regarding the revolving armature with fixed fields, when he first designed a turbo-alternator under conditions described in his paper, he adopted this design. The machine, which was the first made by Messrs. Siemens Bros., turned out quite satisfactory as regarded heating and regulation, but they had difficulties in connection with collecting the alternating current at the high speed at which the machine ran.

The Public Supply of Electric Power.

By G. L. Addenbrooke, M.I.E.E.

(*Abstract of paper read before the* Royal Society of Arts (Cantor Lectures, I) *on January 11th*, 1909.)

Whereas formerly it was thought necessary to supply lighting and power from separate mains, improvements in electrical plant have rendered it possible to supply both from a common system, which also is necessary for the sake of economy. Unfortunately, electric lighting legislation has been and still remains a barrier to electric power supply.

Cost is the most important factor in power supply, which is making rapid progress. Direct statistics are not yet available, but it is estimated that the total horse-power installed in the United Kingdom in factories and mines is over 8 million H.P., and there is also about 1,360,000 H.P. in electric lighting, power and tramway stations: to work all the railways electrically would require well under 2 million H.P., while there must be more than half a million H.P. installed in motor-cars and motor-omnibuses. The amount of power installed for all purposes in this country is about ½ H.P. per head of population. In the United States, with twice the population, the power installed was in 1905, three times as much as in this country, and increased by 40 per cent. between 1900 and 1905, showing the importance of placing no unnecessary obstacles in the way of power supply.

Of the eight or nine million H.P. above-mentioned, some four millions are situated in urban districts, and within the central portions of the areas of the power supply companies, and could be economically supplied by the latter; the remainder being situated in the more rural districts can probably most advantageously produce their own electric supply.

It is estimated that if modern electric plant were installed in all collieries, the coal consumption would be reduced from over 6 per cent. of the total coal raised to one-third of that amount, effecting a saving of three millions sterling per annum. The saving in other industries would not be so great as in mining, but would be quite one-half of the coal used, equivalent to nearly ten millions sterling.

Probably something over 1,000,000 H.P. is privately installed in works which can generate energy economically for themselves.

In 1898 proposals for supplying power from public centres on a large scale first came to a head, and between 1899 and 1905 about 23 Power Supply Acts were passed which practically covered all the industrial areas of the United Kingdom; but the large towns were excluded, and most of the smaller ones with electric lighting powers, so that the Power Companies found the valuable portions of their areas much restricted. On the North-East Coast the difficulty has been overcome by agreement with the company owning the lighting of Newcastle, but in no other district have the circumstances permitted of a similar development.

The lecturer considered that the form in which Parliament arranged that power Acts should be presented to it was unsuitable to, and gave a false view of, this class of undertaking. It prevented

the initial difficulty being properly appreciated, and the need for encouragement realised, and created unnecessary opposition to them.

This opposition altered their engineering schemes as originally presented to Parliament, prevented their being started on the scale which was intended, and forced them to approach the heavier consumers in the more outside area somewhat prematurely, instead of their being able to deal with the smaller factories in the urban districts, where the works were also more concentrated.

They are now, however, after a great deal of hard work, gradually getting over some of these difficulties, though at heavy capital cost.

The companies have not been able, therefore, so far to develop their undertakings on the lines originally intended, or on the large scale necessary to economy in this class of work, and their progress has been greatly retarded. The local authorities have been stimulated to move towards power supply, and are supplying over 26,000 H.P. for power in London, over 35,000 H.P. in Manchester, and 23,000 in Glasgow. They have in all expended some 42 millions sterling, of which, perhaps, 8 or 9 are devoted purely to power supply, but the output for power is not far short of that for lighting, and the price much lower—in some cases at the expense of the lighting consumers. Probably motors of some 260,000 H.P. are connected to the mains of local authorities.

The power companies have spent about 7½ millions, and have some 160,000 KW. of plant installed, with 200,000 H.P. connected. The North-East Coast companies have spent half the total, and supply works with 85,000 H.P., as well as 12,000 H.P. to electro-chemical works. The lighting companies have also spent probably four or five millions on power supply, and have about 100,000 H.P. of motors on their circuits.

Probably motors of nearly 600,000 H.P. are now supplied from all sources, about equally divided between companies and municipalities, with an aggregate capital expenditure of some £20,000,000. Thus the industry of power supply is already a large one, and has great scope for further development.

TABLE SHOWING THE CAPITAL COST OF ELECTRIC SUPPLY UNDERTAKINGS PER KILOWATT AVAILABLE.

I.

Output of station. KW.	Cost of power house per KW.	Allowance for distributing system per KW.	Preliminary expenses, cost of finance and working capital per KW.	Total costs per KW.	Capital cost of undertaking.
2,500	£24	£20	£12	£56	£140,000
5,000	20	16	10	46	230,000
10,000	17	14	8	39	390,000
20,000	15	12	6	33	660,000
40,000	14	10	5	29	1,160,000

Since the power supply movement began 10 years ago there has been a fall of 25 per cent. in the cost of power generated with modern private plant, but still greater progress has been made in plant of large size. Nowadays the smallest power users in industrial areas will pay 1½d. to 1d. per unit for electrical energy, for users of 200 to 400 H.P. 0·85d. to 0·75d. is the limit, and for large supplies over long hours ½d. per unit or less. For a continuous 24-hour load 0·4d. to 0·5d. can be obtained, but for large power supplies continuously throughout the year the price may be ½d. to ¼d. per unit, and the author is aware of one large contract at ¼d. Where coal is expensive the prices must be $\frac{1}{10}$ to ¼d. higher, and in towns an equal increase can be obtained as compared with the more open districts. For such prices the station must be of considerable size—say, 10,000 KW. or more. They work out at £3 to £4 per annum per H.P. of motors installed.

The question of charging for power supply is very difficult; users object to a complicated tariff, and there is a tendency to make contracts at fixed prices.

Light trades use about ¼ to ½ H.P. per man employed; engineering works ½ to 1 H.P.; mines, 1 to 2 H.P.; and textile industries, 1 H.P. per man. Some industries take 5 or 6, but on the average the figure is about 1 H.P. per man. In the majority of trades, the wages paid are 10 to 15 times the cost of power, so that the latter is not a preponderating factor, though an absolutely vital one. Lighting and tramways take about one-sixth of the power employed in industry, and railway supply and heating are important future developments. Apart from the question of price, there are many advantages in taking an electric supply from a large power station, including regularity of drive, which enables better work to be done, and a greater output to be secured from machines. A larger amount of work has been done than is generally supposed, but not yet more than one-sixth of what is possible.

The industry is handicapped by the cost of Parliamentary powers, management, rating and taxes, and the distributing system, and, in the early stages, by the necessity of installing plant in excess of the demand. The central station, on the other hand, has the advantage of the diversity factor; from 2½ to 3 times the output of the station can generally be installed in motors, while the output of the station will not exceed one-half the aggregate maximum outputs of the customers. The load factor is also improved; and if the load factor of a 2,500-KW. station is 26 per cent., that of a 40,000-KW. station will probably be 35 per cent. at least, making a saving of about 10 per cent. in the working costs.

As an approximate indication of the capital costs of public supply undertakings the author gave the accompanying table, in which the actual outputs are taken, the plant installed being ⅓ to ¼ larger than is shown. While the figures given must in no sense be considered as a ready-made guide to power station practice, as local conditions make each project unique in itself and result in considerable variations from a standard, such tables are very useful because they present most of the facts in concrete form, showing the relation of each item to the whole and the extent to which variations in one or more items will affect the whole. The chief feature of the table is the reduction in capital cost per KW. as the size of station increases, tending to a limit beyond which no gain results. The data are in accordance with actual practice at the present day. The range of distribution is from 6 to 10 miles from the station, and the costs do not include local distribution for lighting, or converting sub-stations; transformers and switchgear cost from £4 to £3 per KW.

The reason of the large fall in the cost of the distributing system as the size of the system increases, is that the small stations cannot supply current so cheaply as the larger ones, and therefore have to go further for their custom on an average, and to employ smaller cables. In power supply work it is a good rule to bear in mind that the largest consumer should not exceed in size $\frac{1}{10}$ of the capacity of the station serving him. Small cables cost more in proportion than large ones, as the following data for 11,000-volt distributions will show:—

Section of cable.	Carrying capacity.	Cost laid per mile.	Cost per KW. capacity per mile.
·05 sq. in.	750 KW.	£900	22/-
·10 ,,	1,500 ,,	£1,200	16/-
·20 ,,	3,000 ,,	£1,700	10/6

Preliminary expenses are generally heavy in this country, far heavier than they need be if electrical enterprise were treated with more consideration and encouragement. Parliamentary powers, long negotiations with local authorities, the cost of finance, and various other expenses in the early stages of all undertakings, are very costly; moreover, an undertaking which has grown to large dimensions often has to buy out smaller stations or compensate them by doing unremunerative work, so that the figures given in column 4 are not excessive.

The last column shows approximately the total capital cost for each size of undertaking.

The Improvement of Power-Factor in A.C. Systems.

By MILES WALKER, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS *at Manchester, January 12th*, 1909.)

In many A.C. distribution systems the power factor at light loads is as low as 0·7, and at heavy loads no higher than 0·8; the low power factor limits the output of the generators by its demagnetising effect upon the fields and heating of the windings; regarding the field magnet only, the output at unity power factor is four times as great as at 0·8 power factor lagging, and often the great overload capacity of the turbo-generator cannot be utilised on account of the effect of the lagging current on the fields. The losses in the mains are also increased, as well as the inductive drop, which may rise from 4 per cent. at unity power factor to 18 per cent at 0·8 power factor.

A modern transformer does not take a large wattless component in proportion to its output, because though the total flux generated may be great, the magneto-motive force required to produce that flux is very small. An induction motor, however, having necessarily an air-gap and coils with considerable magnetic leakage, has in it a magnetic field which requires a wattless component of 25 to 30 per cent. of the kilovolt-ampere rating of the motor. For this reason, the induction motor is the main cause of low power factors on our alternating-current systems. The only other offender of importance is the alternating-current arc lamp, which produces a lagging current for a different reason.

Synchronous motors have frequently been employed to provide a leading current to compensate for the lagging current taken by other apparatus. Wherever the synchronous motor can have its power utilised, this plan is a good one, because the cost of giving to the synchronous motor additional capacity to enable it to yield a leading current is not very great. In traction systems employing rotary converters, the power factor can be easily maintained at unity, or even made leading. In one case which has come under the author's notice, turbo-generators were capable of being rated 50 per cent. higher than their normal rating, owing to the fact that they were employed to feed mainly rotary converters.

High-voltage condensers have not come into general use for improving power factor, owing to their large cost.

The reason that the induction motor calls for so large a wattless current is that its magnetising current is supplied at a high frequency. Where, however, the magnetising current is supplied in the rotor at the low frequency of the rotor circuit, the wattless energy required is reduced to 2 or 3 per cent. of that required at the frequency of supply. In 1895 M. Leblanc proposed to supply the magnetising current to the rotors of induction motors and

generators by means of special exciters, which consisted of commutating alternating-current generators whose magnets were excited by the rotor currents. Tests made by the British Westinghouse Co. to see how far Leblanc's method could be carried out commercially, showed that the results agreed well with what might be expected from theoretical considerations. Leblanc has described an exciter which embodies in one machine all phases, and is of a very simple nature.

In 1901 Heyland devised a method of leading currents into the rotor by means of brushes fed from the external circuit, the position of the brushes being such as to make the current which is fed in magnetise the rotor. Such motors have been built in fairly large sizes, and behave as might be expected of them from the theory; but the cost is considerably increased, and the advantage of dispensing with a commutator is lost.

The author believes that it is possible to devise a new type of machine to act as an excitor in the manner proposed by M. Leblanc, which can be made for a small cost as compared with the induction motor, and would be of practical service in cases where it is important to improve the power factor.

Such a machine might be called a "phase advancer." The important features to aim at in its design are—

1. The commutator and brush gear must not be excessively large.

2. The commutation should be induced rather than be dependent on the resistance of the brushes.

3. It should be possible to control the phase of the E.M.F.'s generated by it, and to decrease the slip of the motor rather than increase the slip.

4. The "phase advancer" should be an independent unit, so that in case of its failure the motor could be run as an ordinary induction motor.

Fig. 1 gives the diagrammatic representation of a "phase advancer" which has been designed with these features in view. When wound for three phases the field magnet has three poles (larger machines may have any multiple of three). The armature core resembles an ordinary direct-current armature core, and the coils are like the coils of an ordinary railway motor, except that they have in the case illustrated a span of 120° instead of 90°. One end of each coil, which we will call the inner end, is connected to a star-point. Each outer end is connected to one bar of the commutator. The armature in this way resembles in principle Elihu Thomson's arc-light generator, except that in this case there are a greater number of coils. On the commutator are three brushes

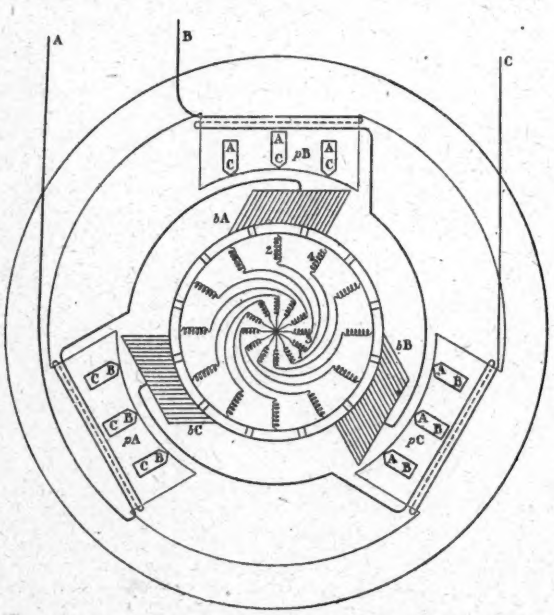


Fig. 1.—Walker Exciter or "Phase Advancer."

which bear upon the segments connected to coils which are for the time being passing under a pole. Each pole is provided with a compensating winding placed in slots in the pole-face, the winding being arranged so that the ampere-wires per inch along the pole-face are equal to or slightly greater than the ampere-wires per inch of periphery of the armature. If we follow one of the armature circuits, commencing from the star-point along coil, 1, 2, it will pass under the pole p C, then under pole p B, and it will make as many turns in front of the poles p C and p B as are necessary to generate the required voltage. It then passes to brush b A and on to the series exciting coil on pole p A, then it passes to the compensating windings marked A in the slots in poles p C and p B, and from these to phase A of the rotor of the induction motor. The currents in the other phases pass through similar circuits, and it will be seen that the E.M.F. generated in any phase is due to a field which is produced by the current in the other two phases.

The difficulty, ordinarily, with a number of armature circuits in parallel would be that the current would not divide equally between all the circuits, but would tend to be greater in those coils under the trailing pole-tip, on account of the greater flux density there produced by the armature reaction. The effect of a compensating winding, distributed as shown, is to equalise the current in all the wires passing under one pole. For if the current in any one coil—say 1, 2—is less than the average of all the coils under the pole, the compensating winding in the middle slot strengthens the field in which coil 3, 4 is moving, and strengthens the current in this coil, which in the next instant takes up the position occupied by coil 1, 2.

It would, in fact, be possible, by making any particular distribution of current in the compensating winding, to produce a somewhat similar distribution of current in the armature beneath the pole, and this gives great facility in arranging the commutating properties of the machine.

Fig. 1 only shows one series coil on each pole. It is, of course, possible to put additional series coils of any number of desired turns connected to any of the phases, so that the E.M.F. generated in an armature circuit can be made of any desired phase.

By the use of an exciter in the rotor circuit it will be possible to greatly increase the output of a motor frame. Even without changing the construction of the stator, its output will be increased in so far as it is operated at unity power factor instead of at a lower

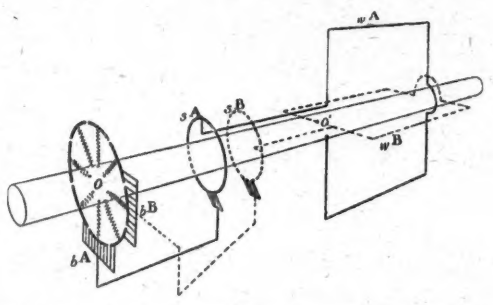


Fig. 2.—Phase Advancer Direct Connected to a Two-Phase Rotor.

power factor. The magnetising current being transferred to the rotor, that element will be worked harder. Rotors as usually made can stand 10 or 20 per cent. more current without exceeding the temperature guarantees. In any case, a slight addition to the copper of the rotor would enable it to carry the requisite leading current.

But a much greater gain in output can be secured by deepening the slots of both stator and rotor, and putting in bigger conductors. At present the depth of the slots is limited because it is so desirable to keep down the leakage flux and the length of saturated teeth. But when the exciting current is supplied to the rotor these considerations are not nearly so important. The slots in the stator and rotor can then be deepened until the leakage flux begins to excessively saturate the rotor iron. The limitation of an induction motor frame will then be by considerations similar to those which now obtain with synchronous motors. The pull-out torque of an induction motor will be very much increased by the use of a phase advancer, because not only can the working flux be kept up to its full value, but it is kept more nearly in phase with the stator currents.

Another use for an exciter in circuit with the rotor of an induction motor is to change the speed of the motor. It may also be employed for exciting the rotor of an induction generator.

If we excite the rotor of an induction generator with a leading current, the armature becomes capable of supplying a wattless component to help any synchronous generators in parallel with it. Fig. 2 shows diagrammatically a method of exciting a two-phase rotor of an induction turbo-generator by means of a "phase advancer." The rotor and "phase advancer" are mounted on the same shaft. w A and w B show diagrammatically the two-phase winding of the rotor. One end of each phase is connected to the shaft at o'. The other ends are connected to the collector rings s A and s B, and from these rings the current is collected by means of brushes and carried to the brushes of the phase advancer b A and b B, which in this case would be provided with four poles, not shown in the diagram. The inner ends of all the armature coils are connected to the shaft at the point o, and the operation of the exciter is exactly the same as in the case described in fig. 1, except that two phases are employed instead of three. It will, however, be seen that the brush capacity of the whole set is exactly the same as might be employed with ordinary direct-current excitation; in fact, no one looking at such a set would be able to say whether the excitation was by direct or by alternating current. If at any time it became necessary to run the machine as a synchronous set, all that would be necessary would be to excite the field magnets by means of coils connected as a shunt.

An important subject to be discussed by our station engineers is the means which can be employed for inducing consumers to improve their power factor. The rates charged for electrical supply commonly in vogue, do not take account of the power factor of the consumer's load. Station engineers, while exercising some control over the character of the motors installed, do not as a rule offer the consumer sufficient inducement to improve his power factor. When we remember that the capital charges (especially for mains) form such a large proportion of the total costs of supplying electricity, and also the small proportion which the cost of coal bears to the

total cost, in many cases it would seem to be fairer to charge the consumer by the kilovolt-ampere than to charge him by the kilowatt.

DISCUSSION.

MR. S. J. WATSON (in the chair) said there was no doubt that the power factor had a very great influence on the costs of the supply. Where large sub-stations were employed, using rotary transformers, the problem was fairly easily solved by adopting different types of rotary transformers, but present-day practice was tending more to the distribution of A.C. without converting into D.C. With regard to the differential method of charging a consumer with a low power factor, he thought the consumer would kick against it very strongly. Another point was, who was to provide this power factor regulating device. Possibly some means might be devised which would put on the consumer the necessity of providing such apparatus, but there were difficulties in the way. If a consumer were charged through an ampere-hour meter, he was being charged for units which had not been generated, and if some of the consumers got that idea, there would be trouble. The motor load was not the only kind of load which produced lagging currents; quite appreciable difficulties were being found in some towns through the employment of small transformers in connection with metallic-filament lamps.

MR. F. C. RAPHAEL said, as Mr. Watson pointed out, it would be impossible to make a consumer increase the cost of his motor by adding this device, and when consumers were using induction motors that gave very little trouble, it would be very undesirable that they should complicate them by adding a device with a commutator to it. The disadvantage of putting any device at the generating station end was that the feeders were carrying the additional lagging current, but too much had always been made of the additional losses in the feeders. The chief loss was that the K.V.A. rating of the generator was different to the KW. rating, and consequently with a bad power factor less output was got from the generators. It should be very simple indeed to devise an apparatus, easy to regulate at the power station end, possibly combined with the generator itself.

MR. J. FRITH said the paper was full of new ideas. Many exceedingly ingenious people had been on the brink of making an induction motor having a unity power factor and still nothing really commercial had come of it.

MR. A. E. MCKENZIE said that up to the present they had not been troubled with bad power factors in Manchester. It was rarely indeed that the power factor of the station fell below ·95. He agreed that it should be possible to charge consumers according to their power factor. It would be better if this "phase displacing" device were installed at the generating station.

MR. C. F. SMITH was struck by the exceedingly neat method of expressing the volt-amperes spent in exciting an A.C. circuit as the production of E.M.F. On the other hand, he disliked the term "wattless power." If this or some similar arrangement became general in connection with induction motors, undoubtedly the system of design would be very largely affected indeed. The whole device of the "phase advancer" and induction motor together consisted really of a rotor combined with a booster having a variable frequency. He would like to ask what objection there would be to carrying out a suggestion he had himself made, of exciting the booster with continuous current, instead of this slowly alternating current. In that case, as stated, the motor would be running as a synchronous motor, excited from the rotor, instead of an asynchronous motor with slow periodicity booster. The motor would run synchronously under normal conditions, keep over excited or under excited, and could further be made to give either a leading, lagging, or a unity power factor. If it fell out of step through overloading, the rotor would be short circuited through the armature of the booster, and the machine would then behave simply as an ordinary induction motor.

MR. J. S. PECK said that the machine the author referred to, was in principle quite similar to the single-phase railway motor. The latter could run at any speed with a fixed frequency. It also had the peculiar characteristic that it could run as a generator at any speed, and deliver current of a fixed frequency, and that was what was done in the author's machine. If run as a generator with the field excited with A.C., you got an alternating current on the armature. This was of the same frequency, as the frequency which excited the field, and by changing the phase regulation it was possible to change, advance or retard the direction of the current delivered by the armature. There was surely a very great objection to the introduction of commutating devices on induction motors.

MR. W. CRAMP said that in a Midland town the power factor rarely rose above ·72 and frequently was down to ·66. There was a large motor load, and since the object of every central station engineer now was to obtain a good motor load, it followed that the importance of the subject must increase. In 1903 he made some repulsion motors with wide brushes, which short-circuited many of the coils. He found it quite possible to get them running excellently electrically, but it was utterly impossible to keep the commutator cool owing to the friction of the wide brush. Another difficulty of commutation under these conditions was the use of a composite brush. He made the brush of more than one material, but the changes in the rate of expansion, due to heat of the two or three sorts of material used, were sufficient to damage the brush at the corners.

Messrs. T. H. Swinburne, J. W. Stelling and H. C. Crews also spoke.

MR. MILES WALKER, in reply, said that it was quite possible that the price of the motor could not be sufficiently reduced to pay for the phase advancer, but he thought the cost of the motor could be reduced a good deal, and there would be occasions where customers would prefer it. The efficiency would probably be reduced a little. With regard to the device in the station, the difficulty was the K.V.A. rating of the machine. The whole point of the phase advancer was with this K.V.A. rating, and its cost was very much smaller than the cost of a synchronous motor doing the same work. One of the troubles with this system was that the phase advancer did not enable them to compensate the wattless current when starting a motor. To do this it would have to be of very large size and at very high frequency.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

BRITISH NEW GUINEA.—The following are free of duty:—Agricultural and mining implements, machines and tools and parts thereof; axles and wheels; steam boilers and boiler plates; cement, copper (sheet, plain, rods), tacks, nails; coal and coke; drain pipes; steam and gas engines; galvanised iron, corrugated; iron and steel rails, and wagons for running thereon, including plates, bolts and nuts therefor; iron and steel, plain, sheet, rod, scrap, hoop; steam engines; carding, spinning, ice making, printing, &c., machinery; tar; telegraph and telephone machinery and materials.

Earthenware	10% ad val.
Glass and glassware	10% ad val.
Gutta-percha and india-rubber and manufacturers thereof	10% ad val.
Wire	10% ad val.
Other electrical and similar goods	5% ad val.

The value on which duties are levied is the net invoice value (not to include the value of outside packages) of the goods at the port of shipment, which will be taken to be the fair market value at the place whence the goods were last exported.

The administrator has the exclusive privilege of establishing, erecting, maintaining and using stations and appliances for wireless telegraphy, but licences may be granted by him on payment of such fees as may be prescribed.

BRITISH NORTH BORNEO.—Importers have now to fill in a written declaration of their goods, instead of certifying verbally as hitherto. The original invoice must be produced.

Brass or copper wire	10% ad val.
Building materials: bricks, tiles, lime, pipes, roofing and paving material and cement	5% ad val.
Coal and coke	50c. per ton.
Earthenware, crockery and porcelain	10% ad val.
Glassware	5% ad val.
Lamps and lanterns	10% ad val.
Machinery worked by steam or water power, and labour-saving machines not worked by steam power	10% ad val.
Machinery for shipbuilding	free.
Metals—manufactured	10% ad val.
unmanufactured	5% ad val.
Railway, telegraph and tramway materials and rolling stock	10% ad val.
Other electrical and similar materials	5% ad val.

BULGARIA.—It is imperative that the exact net and gross weights in kg. should be marked on each package and specified on bills of lading and certificates of origin for all goods exported to Bulgaria. The net weight of each class of goods should be stated, and the origin of the goods should be declared on all documents. Duty is payable on the gross weight in the case of goods dutiable at a rate not exceeding 10 fr. per 100 kg. In order to secure entry under the lower rates of the conventional tariff which is applicable to British goods, imports should be accompanied by certificates of origin, which may be issued and signed by Customs houses, Chambers of Commerce, or Bulgarian diplomatic or commercial agencies. The following form of certificate of origin has been decided on:—

I (name of person signing the certificate) certify that it appears from the documents produced before me that (name of manufacturer or merchant) on the (date), 190 , shipped from this port of (name of port) (numbers and descriptions of packages) marked ..... Nos. ..... of ..... kg. gross weight, containing (general description of merchandise), which goods are the {produce / manufacture} of this country and are destined for the port of (name of port of landing) on account of (name of consignee) {at / to order} (place of destination).

Date, signature and seal.

Franc = 9$\frac{6}{10}$d., or 25 francs = £1. kg. = 2·204 lb.

	Fcs. per 100 kg.
Coal, coke, or briquettes for heating	2·50
Graphite (plumbago)	2

	Fcs. per 100 kg.
Cements of all sorts	1·25
Drain pipes of clay	1
Pipes and other wares of compressed cement or mortar	5
Pipes or stoneware, glazed of all sorts	10
Insulators for electric circuits...	12
Small wares of porcelain, china, &c.	40
Common glass for insulators	10
NOTE.—Includes large tubes of glass for insulating subterranean telephonic or electric wires.	
Lamp glasses, ordinary or crystal	20
Electric arc lamps with or without their fittings ...	60
Small incandescent electric lamps, mounted or not	100
Shades made of any sort of paper, coloured or not	95
Transmission belts for use in industries	free
Transmission belts, other, of leather of all sorts ...	150
India-rubber and gutta-percha, raw or melted, in mass; gutta-percha tubes, transmission belts, and india-rubber valves, for use in national industries (under certain conditions)	free
Unvulcanised india-rubber in sheets, films, slabs, or strips; and vulcanised india-rubber thread	100
Tubes, belts, valves, and other manufactures of soft india-rubber or of gutta-percha, pure or mixed, combined or not with tissues or other common materials	50
Manufactures of ebonite (hardened india-rubber), combined or not with other common materials	350
All articles of india-rubber or gutta-percha combined with materials that pay higher duties than the india-rubber or gutta-percha	Dutiable at the rate applicable to such materials.

(To be continued.)

NEW PATENTS APPLIED FOR, 1909.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

1,263. "Improvements relating to high-tension magneto-electric apparatus." F. R. SIMMS and SIMMS MANUFACTURING CO., LTD. January 18th. (Complete.)

1,270. "Improvements in telephone exchanges." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) January 18th. (Complete.)

1,305. "Improved rail-sanding apparatus to be fixed to electric or other tramcars and the like." R. CARRICK and C. PROCTOR. January 19th.

1,316. "Improved electrode for search lights." SIEMENS BROS. & Co. (Date applied for under Sec. 91 of the Act, April 9th, 1908, being date of application in Germany. Application for Patent of Addition to No. 13,071/07.) January 19th. (Complete.)

1,327. "Improvements in dynamo-electric machines." A. BOECKEL, O. GRUNDBERY, J. K. KRUKOWSKY and E. LUXEMBOURG. (Application for Patent of Addition to No. 20,098/08.) January 19th. (Complete.)

1,332. "Improvements in metal-filaments and in the process of manufacturing the same." H. KUZEL. (Date applied for under Sec. 91 of the Act, February 22nd, 1908, being date of application in Germany.) January 19th. (Complete.)

1,340. "Improvements relating to secondary batteries." E. J. S. DE ST. LAURENT, E. W. LANCASTER, H. T. MCNEALE, J. W. COLLINS. January 19th.

1,345. "Improvements in aluminium electrolytic cells." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) (Date applied for under Rule 13th, September 4th, 1908. An invention comprised in application No. 18,619, dated September 4th, 1908.) January 19th. (Complete.)

1,386. "Improvements in or relating to switch holders for electric lamps and the like." J. W. HINTZE. January 20th.

1,401. "Improvements in apparatus suitable for electric signalling, advertising and like purposes." ELECTRIC SIGN AND GENERAL ADVERTISING CO., LTD., and W. GIBBS. January 20th.

1,405. "A method of obtaining a phonographic record of telephone messages and apparatus therefor." R. A. LEHFELDT. January 20th.

1,414 and 1,415. "Improvements relating to electrical heating apparatus." A. F. BERRY. January 20th.

1,419. "Improvements in electric telegraphy." A. MUIRHEAD. January 20th.

1,421. "Improvements in and relating to secondary batteries." P. MARINO. January 20th.

1,425. "Improvements in or relating to the insulation of electric conductors and compounds therefor." F. HUTCHINS. January 20th.

1,436. "Improvements in obtaining copper and other metals by the electrolytic process, and in septa for separating solutions." H. E. DOLPHIN. January 20th.

1,448. "Improved method of making an electrolyte to facilitate carriage of same." B. E. R. NEWLANDS, J. J. EASTICK and F. J. ROUSE. January 21st.

1,493. "Improvements in antiseptic attachments for telephones." F. C. TABLER. (Date applied for under Sec. 91 of the Act, January 24th, 1908, being date of application in United States.) January 21st. (Complete.)

1,503. "Process for the treatment of wood to be manufactured into porous separators for separating electric accumulator electrodes." P. MARINO. January 21st.

1,509. "Improvements in and relating to the regulation of the current and voltage in dynamo-electric machines." SIEMENS BROS. DYNAMO WORKS, LTD., (Siemens-Schuckertwerke G.m.b.H., Germany.) January 21st. (Complete.)

1,510. "Improvements in and relating to electric fuse-holders." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens Schuckertwerke G.m.b.H., Germany.) January 21st. (Complete.)

1,521. "Improved device for the automatic operation of switches for tramway lines from the tramcar." F. DAHLHEIM and G. VOGT. January 21st.

1,541. "Means for preventing flickering in arc lamps with parallel carbons." D. TIMAR and K. VON DREGER. (Date applied for under Sec. 91 of the Act, July 18th, 1908, being date of application in Germany. Application for Patent of Addition to No. 12,656 of 1908.) January 21st. (Complete.)

1,548. "Improvements in or relating to telephone apparatus." A. J. BOULT. (International Telechronometer Co., United States.) January 21st. (Complete.)

1,551. "Improvements in electric telegraphic typewriting machines." L. CERREBOTANI. (Date applied for under Sec. 91 of the Act, January 22nd, 1908, being date of application in Germany.) January 21st. (Complete.)

1,614. "Improvements in or relating to electric traction systems." E. M. MUNRO and RAILLESS ELECTRIC TRACTION CO., LTD. January 22nd.

1,626. "Improvements in the exhaustion of metal-filament electric lamps and other apparatus requiring a high vacuum." T. A. ROSE. January 22nd.

1,633. "Automatic electric alarm." H. COSTE. January 22nd.

1,641. "Improvements in contact-breakers for use with magneto-electric machines." F. R. SIMMS and SIMMS MANUFACTURING CO., LTD. January 22nd.

1,642. "Improvements in electrodes for electric accumulators." H. LEITNER. January 22nd.

1,651. "Improvements in means for balancing end thrusts in dynamo-electric machine." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) (Date applied for under Rule 13, August 18th, 1908; an invention comprised in Application No. 17,380, dated August 18th, 1908.) January 23rd.

1,652. "Electrical game apparatus." T. BIRNBAUM. January 23rd.

1,663. "Improvements in electric switches." E. J. SELBY, W. SANDERS and W. PRESTON. January 23rd.

1,673. "Improvements in lampholders for electric incandescent lamps." T. BIRCHALL. January 23rd.

1,675. "Improvements in electric ironclad switches." T. BIRCHALL. January 23rd.

1,679. "Improvements in and relating to the cooling of the windings of dynamo-electric machines." SIEMENS BROS. DYNAMO WORKS, LTD., and M. KLOSS. (Siemens-Schuckertwerke G.m.b.H., Germany.) January 23rd. (Complete.)

1,696. "Improvements relating to circuit-breakers and the like for the protection of electric induction motors." G. ELLISON. (Date application for Patent of Addition to No. 13,285, of 1907.) January 23rd.

1,705. "Improvements in and relating to alternating-current electric machines of the commutator type." ALLGEMEINE ELEKTRICITATS GES. (Date applied for under Sec. 91 of the Act, January 24th, 1908, being date of application in Germany.) January 23rd. (Complete.)

1,706. "A process for dividing electric current, applicable to mercury, arc, or other electric lamps and apparatuses." L. A. AUDIBERT. January 23rd. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. THOMPSON & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1907.

ELECTRICAL TRANSMITTING APPARATUS FOR CONTROLLING THE SIGHTING OF GUNS. A. T. Dawson and G. T. Buckham. 21,414. September 26th.

MAGNETIC SEPARATING MACHINES. Rapid Magnetting Machine Co., H. H. Thompson and A. E. Davies. 28,014. December 19th.

MAGNETIC SEPARATING MACHINES. Rapid Magnetting Machine Co., H. H. Thompson and A. E. Davies. 28,015. December 19th.

CONTROL OF ALTERNATING-CURRENT ELECTRIC INDUCTION MOTORS, AND OF THE MEANS DRIVEN THEREBY. H. A. Mavor and Mavor & Coulson, Ltd. 28,040. December 19th.

ELECTRIC MEASURING INSTRUMENTS. W. Moseley. 28,080. December 20th.

TELEPHONE TRANSMITTERS. W. Moseley. 28,081. December 20th.

METHOD OF MANUFACTURING ARTIFICIAL PLATES FOR INSULATING AND OTHER PURPOSES. E. Weidinger née Dresser and H. Kahn. 28,117. December 20th.

APPARATUS FOR GALVANISING OR TINNING AND ANNEALING WIRE PLATES, AND THE LIKE. S. O. Cowper-Coles. 28,636. December 30th.

1908.

ELECTRIC LAMP CANDLE FITTINGS. C. M. Escaré, P. F. Escaré and C. Damey. 104. January 2nd.

TROLLEYS OR COLLECTORS FOR ELECTRICITY. J. Shepherd and F. B. Ullery. 153. January 2nd.

ELECTRICAL DISTRIBUTION. A. J. Boult. (J. L. Woodbridge, United States.) 345. January 6th.

ELECTRICALLY-OPERATED RAILWAY SWITCH POINTS AND SIGNALS. A. H. Johnson. 2,035. January 30th.

ELECTRIC IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. British Thomson-Houston Co. and B. Hopps. 3,985. February 21st.

SHIP'S TELL-TALE TELEGRAPHIC APPARATUS. Chadburn's (Ship) Telegraph Co. and A. J. Grant. 5,172. March 7th.

INSULATED ELECTRIC CONDUCTORS, CONTACTS AND THE LIKE. E. N. Bray and F. I. Bray, Markham & Reiss, Ltd. 8,962. April 24th.

MEANS FOR THE ELECTRIC REGULATION OF THE RUNNING OF VEHICLES. R. C. Sayer. 10,006. May 8th.

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